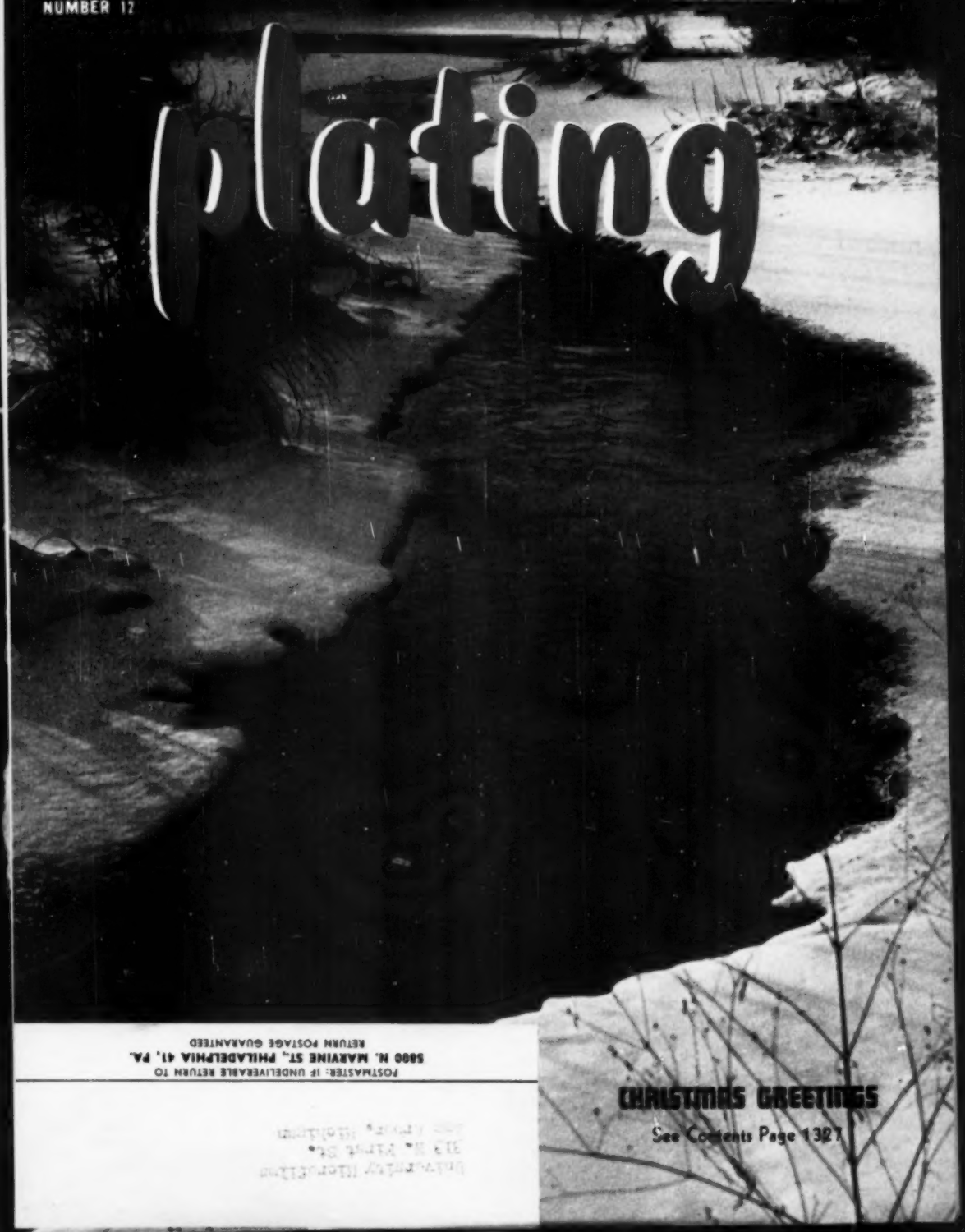
VOLUME 39
NUMBER 12

DECEMBER, 1952

plating



CHRISTMAS GREETINGS

See Contents Page 1327

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NEW SOLUTIONS FOR OLD FINISHING PROBLEMS

ENTHONE CAN SHOW YOU HOW TO DO ANY OF THE FOLLOWING:

1. Remove rust and scale from steel in an alkaline solution *without any attack on the steel*
2. Strip nickel, lead, tin, solder, silver and copper from steel without any attack on the steel
3. Electroplate on aluminum for soldering
4. Remove excess silver solder from steel
5. Phosphate and clean steel in one operation
6. Prevent rusting of steel during drying or storage
7. Shorten alkali cleaning time to seconds.
8. Strip enamels from plastics
9. Remove heat scale from copper alloys without etching the base metal
10. Chromate zinc and cadmium for high salt spray resistance

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METAL FINISHING PROCESSES

ELECTROPLATING CHEMICALS

One of a number of different Tumbling barrels in which sample parts are processed in the new Norton barrel-finishing department.

New Norton sample processing department helps manufacturers speed up production

Plan now to take advantage of this new enlarged service department.

If you'd like to find faster methods for deburring and forming uniform radii on vitally needed parts — or if you have special problems in finishing parts ranging from tiny needles to castings and forgings weighing several pounds — send us samples of your parts. Tumbling is very likely the answer to your problem. And the new Norton sample processing department is the ideal set-up for finding just exactly what you can accomplish through barrel-finishing. Many manufacturers have already realized substantial savings and speed-ups in production through this service.

This new Norton department has a variety of Tumbling barrels of different types and capacities plus auxiliary equipment such as a mechanically vibrated screen. Here, Norton production engineers determine for you — without charge or obligation — just exactly what tumbling can do for the metal parts you send. Detailed recommendations are then given so that you can know exactly how to get the best results for your particular problem. These recommendations include barrel type, size and speed, size and amount of ALUNDUM* Tumbling Abrasives to be used, amount of water, type and amount of compound or cleaner, time cycles and other data.

Send Samples Now

For sample processing, we need: representative sample parts plus (a) the finished sample to be matched (hand-finished, if necessary) and (b) information on your present barrel-finishing equipment, if any, including type and size of barrel and barrel speeds. These should be sent to Norton Company, Worcester 6, Massachusetts, attention of Sales Engineering Department, Abrasive Division. About a week is required for processing the samples after they have been received.

Meanwhile, for further information get the 55-page Norton handbook on barrel-finishing. Ask your Norton Distributor for Form 501 or write us direct.

*Trade-Mark Reg. U. S. Pat. Off.

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Chromium wastes, because of their toxicity and high color, are a problem for industry and an annoying source of stream polution.

Reduction of toxic hexavalent chromium wastes to the trivalent form with sulphur dioxide, and subsequent precipitation with alkali, has become widely accepted in the plating industry. Wallace & Tiernan offers not only the equipment for feeding sulphur dioxide but also the experience of many installations to successfully carry out the reduction process.

CYANIDE WASTES

Wallace & Tiernan's service to the metal finishing industry also includes experience and equipment for effective destruction of cyanide wastes by alkaline chlorination. Automatic control equipment assures complete cyanide destruction with minimum chemical costs.

Write today for additional information on Wallace & Tiernan equipment for the reduction of toxic chromium wastes with sulphur dioxide and the oxidation of cyanide wastes by alkaline chlorination.

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S-78

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AMBLER ACP PENNA.

Technical Service Data Sheet
Subject: RUST PROOFING WITH PERMADINE®

INTRODUCTION:

Ferrous metal parts that have been Permadized in a zinc phosphate chemical solution and then "sealed" with a rust-preventive oil such as "Granoleum" are effectively protected from rust-damage. In addition, if the surface is accidentally chipped or scratched, rusting is confined to the exposed area.

Rust proof coatings find many practical applications. During World Wars I and II most small arms were rust proofed by phosphate coating and impregnated with chromic acid and a rust preventive oil, or cutback petrolatum. This not only provided excellent corrosion resistance but also yielded a dull black non-reflecting surface. Rust proof finishes are now used widely on hardware, firearms, cartridge clips, metallic belt links, miscellaneous forgings and castings, tools, unpainted replacement machine parts, and many other similar items such as bolts, nuts, and washers.

THE PERMADIZING PROCESS:

For the most effective rust proofing of large or small work in large or small production, "Permadine" is used in tanks in an immersion process, with the bath heated to 190°-210°F., coating time 20 to 30 minutes. The coated parts are then rinsed in clean water, and then in a controlled dilute acidulated solution. After drying, a suitable corrosion-resistant oil such as "Granoleum" is applied.

Operations can be carried out with the work in crates, or hung from hooks, utilizing an overhead rail and hoists. For large volume production, automatic equipment can be used to mechanize the line. Small parts can be treated in tumbling barrels.

"PERMADINE" MEETS SERVICE SPECIFICATIONS:

The protective "Permadine" finish meets U.S.A. 57-0-2C; Type II, Class B, and equivalent requirements of:

MIL-C-16232,
Type II
U.S.A. 51-70-1,
Finish 22.02, Class B
AN-F-20
Navy Aeronautical M-364
JAN-L-548

"PERMADINE" DATA CHART

Type of coating	Zinc phosphate
Object of coating	Rust and corrosion prevention
Typical products treated	Nuts, bolts, screws, hardware items, tools, guns, cartridge clips, fire control instruments, metallic belt links, steel aircraft parts, certain steel projectiles and many other components
Scale of production	Large or small volume; large or small work
Method of application	Dip Barrel tumbling, racked or basketed work
Equipment notes	Immersion tanks of suitable capacity. Cleaning and rinsing stages can be of mild steel. Coating stage can be of heavy mild steel or stainless steel.
Chemicals required	"Permadine" No. 1
Pre-cleaning methods	Any common degreasing method can be used. Alkali cleaning ("Ridosol"), Acid cleaning ("Deoxidine"), Emulsion-alkali cleaning ("Ridosol"-"Ridoline"); vapor degreasing, solvent wiping, etc., are examples. Acid cleaning may need to follow other cleaning methods if rust or scale is present.
Bath Temperature	190° - 210°F.
Coating time	20 - 30 minutes
Coating weight range Mgs./Sq. Ft.	1000 - 4000
Technical Service Data Sheets	No. 7-20-1-2 T. M. No. 5

CHEMICALS ACP PROCESSES

WRITE FOR FURTHER INFORMATION ON "PERMADINE" AND YOUR OWN METAL PROTECTION PROBLEMS

CHEMICALS ACP PROCESSES

In This Issue

Metal Recovery by Ion Exchange by C. F. Paulson discusses the recovery of zinc, tin, copper, chromium, nickel, silver and gold by use of ion exchange systems. The paper is illustrated with three figures and four tables which include a cost comparison of disposal as against ion exchange recovery of plating plant wastes. A list of eight references is also provided for those readers desiring further information on the subject.

Notes on the Electrodeposition of Thick Gold Deposits by Charles L. Bauer describes the development of a bath for the production of smooth electroformed gold objects. Studies were carried on with cyanide baths to which additions of vanillin and sodium sulfite appeared to be advantageous. The use of lithium cyanide as a means of controlling the carbonate content of the bath is detailed.

Corrosion of Iron and Its Prevention by Deposits of Non-Ferrous Metals by Dr. U. R. Evans is a synopsis of a lecture presented at Sheffield, England in which the author discussed corrosion and protection in connection with the present metal shortage. The five main points of his lecture are neatly summarized.

Philadelphia Branch, Host for 40th Annual A. E. S. Convention is the third part of the pre-convention news in which the contributing parts to be played by the Allentown-Reading and Lancaster Branches is described, and advance information on part of the program is released.

Effects of Impurities and Purification of Electroplating Solutions I. Nickel Solutions 6. The Effects and Removal of Iron by Dr. Dwight T. Ewing, Arthur A. Brouwer and John K. Werner is the sixth of a series. The effects of iron as an impurity in four types of nickel plating solutions were investigated and data are presented on the indicated changes in six physical properties of the nickel deposits; appearance, adherence, ductility, hardness, salt spray corrosion resistance, and throwing power. Removal methods studied were high *p*H precipitation and low current density electrolysis.

For page number, see Table of Contents, page 1327

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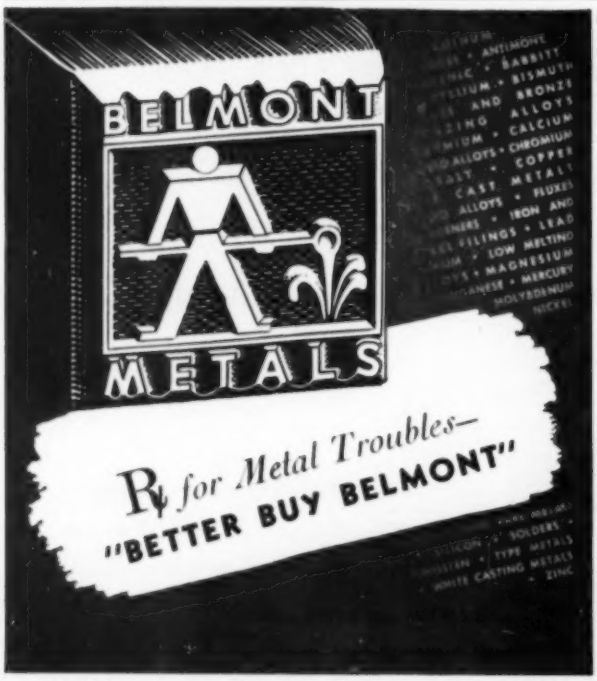

306 Belmont Avenue, Brooklyn 7, N. Y. Dickens 2-4900

Industry News

Gaillard Seminar, January, 1953. Dr. John Gaillard, mechanical engineer on the staff of the American Standards Association and lecturer at Columbia University, will hold his next five-day private seminar on industrial standardization from January 26-30, 1953, in the Engineering Societies Building, 29 W. 39th St., New York City. These seminars were started in 1947 upon request from companies for assistance in the organization of their standardization work and the training of their men in writing standard specifications. For further details and registration write to Dr. John Gaillard, 400 W. 118th St., New York 27, N. Y.

Bridgeport Brass Opens New Philadelphia Warehouse. Because of the increasing demand for brass and copper mill products caused by industrial expansion in the middle Atlantic area, the Bridgeport Brass Company of Pennsylvania has opened a new warehouse in Philadelphia at 918 E. Lycoming St. The sales and operations will be in charge of David F. Snow, their District Sales Manager.

Speer Carbon Company Makes Motor and Generator Brushes on Stokes Press. Speer Carbon Company, Saint Marys, Pa., recently installed a Stokes Model 280-G single-punch powder metal press for molding motor and generator brushes individually. Formerly the pieces were molded in large plates, after which the plates were cut up into smaller pieces.

"Individual molding of these parts has resulted in substantial savings to us", remarked a company spokesman. "Principal reason is the production speed possible on our stokes press, which makes up to 24 pieces per minute".

Manufacturers of a great variety of carbon and metal-graphite brushes and parts for over fifty years, Speer Carbon Company now makes in addition, contacts for electrical equipment, carbon discs, and graphite and metal-graphite bearings.

New Ion Exchange Process. Demineralization of high pressure boiler feedwater for Central Station operation was disclosed for the first time by Martin E. Gilwood, Director of Research, The Per-

WANTED

Salesmen to sell competitive line of plating chemicals including Cadmium Balls, Potassium Cyanide, Nickel Salts, etc. Salary and bonus or commission arrangements. *Reply to:*

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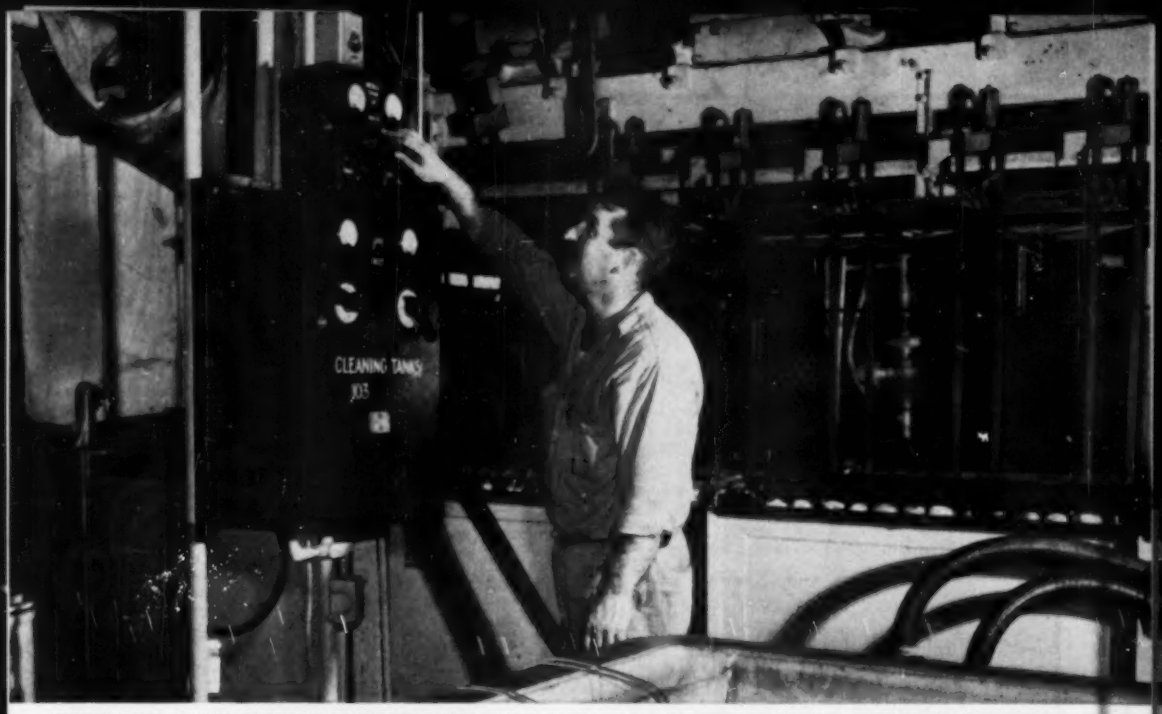

CONTROLS FOR PLATING EQUIPMENT AT GILLETTE SAFETY RAZOR COMPANY ARE CONVENIENTLY LOCATED ADJACENT TO PRODUCTION LINE.

G-E Rectifiers assure steady production reports Gillette Safety Razor Company

G-E PLATING RECTIFIERS, installed in a separate room away from plating area, minimize maintenance. Only occasional inspection and cleaning are required.

"No shutdowns of plating line from current failure"

General Electric metallic rectifiers supply d-c power for electrolytic cleaning, and nickel and gold plating of safety razors at the Boston plant of the Gillette Safety Razor Company.

An automatic conveyor system moves racks of razors through a series of twelve tanks and a dryer. In only 30 minutes, the razors are cleaned, electrolytically cleaned, rinsed, re-rinsed, acid rinsed, nickel plated, rinsed three times, and dried.

To operate with such precise timing, completely dependable equipment is a real necessity. That is why Gillette relies on G-E metallic rectifiers for its d-c power.

STEADY PRODUCTION—"Never have our G-E plating rectifiers caused a production shutdown due to current failure," reports Howard Spaulding, Chief Electrical Engineer at Gillette.

EASY TO MAINTAIN—"Furthermore, the G-E rectifiers require practically no maintenance—only occasional inspection of contacts and switches," Mr. Spaulding adds.

SAVE POWER—Because controls regulate d-c output by controlling a-c input, power is always adjusted to actual load requirements.

FLEXIBLE—Since plating rectifiers need no special foundations, units may be shifted for the most efficient arrangement, as requirements change. G-E plating rectifiers may be tier-mounted if space is at a premium, and additional units can be added if more power is needed.

FOR MORE INFORMATION about G-E metallic plating rectifiers, consult your G-E representative or write to Section 464-11, General Electric Co., Schenectady 5, N. Y.

GENERAL ELECTRIC

FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A 1408.

A. E. S. ANNUAL PROCEEDINGS

39th Annual PROCEEDINGS (in print)

Technical papers presented at the 1952 Chicago Convention, including ion exchange for chromic acid solutions, waste prevention, filtration, rhodium plating, black nickel plating, engineering materials and materials of construction for plating rooms and waste water treatment systems, vacuum metallizing, current distribution in barrel plating, white brass plating, heavy anodic coatings, instrumentation and three Research Committee reports.

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38th Annual PROCEEDINGS

Technical papers presented at the 1951 Buffalo Convention. See page 849 of October PLATING (1952) for listing.

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Room must be made to stock the 1952 PROCEEDINGS. Past copies of the PROCEEIDNGS are therefore reduced.

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Industry News

mutit Company, 330 W. 42nd St., New York 36, N. Y. This newest development, an automatically regenerated Mixed Bed Demineralizer, was discussed during delivery of a paper at the Fall meeting of the American Institute Chemical Engineers Society at Chicago, Ill. At high operating pressures of modern boiler and turbine systems, difficulties with scale, deposits and carryover in the steam are multiplied.

With the introduction of a mixed bed demineralizing system, it is now possible to produce water which is low in electrolyte and low in dissolved silica through the medium of ion exchange. Demineralization of high pressure boiler feedwater makes possible trouble-free steam power plant operation and is being looked at with keen interest by all engineers.

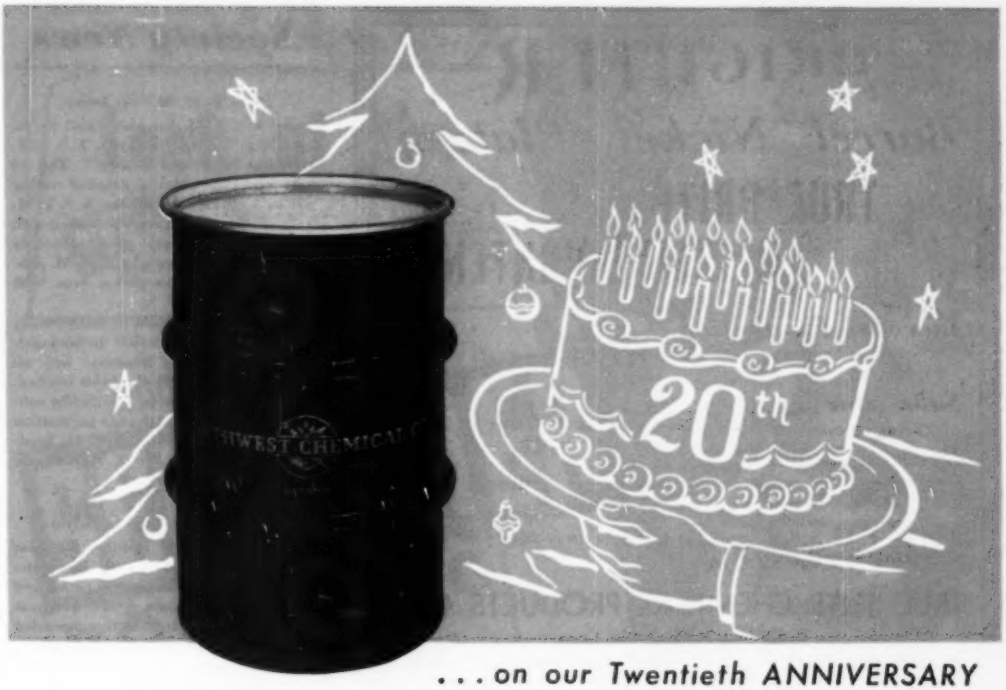
Barber-Webb Company, Inc., Opens New Plant. The Barber-Webb Company, Inc., opened a new plant at 3864 Santa Fe Ave., Los Angeles 58 (Vernon), Calif., into which the facilities for plating and processing tanks, plating racks, basket coating and other departments have been moved from the former plant in South Gate, Calif.

The new plant contains 41,000 square feet of production area, quadrupling the former facilities. Among the new departments is one involving new processes for the application of recently developed plastic materials. The new plant also contains fully equipped departments for lining tanks with Koroseal as well as with the Paraline series of acid resistant materials.

The firm is the exclusive licensee in the area for the B. F. Goodrich Company's Koroseal Tank Lining material as well as for the products of American Anode Company. Barber-Webb also uses Stoner-Mudge Company's and United Chromium Company's products in connection with its protective coating applications. The firm's technical staff was augmented by the addition of Mr. George Bouffard.

REAL SALES OPPORTUNITY

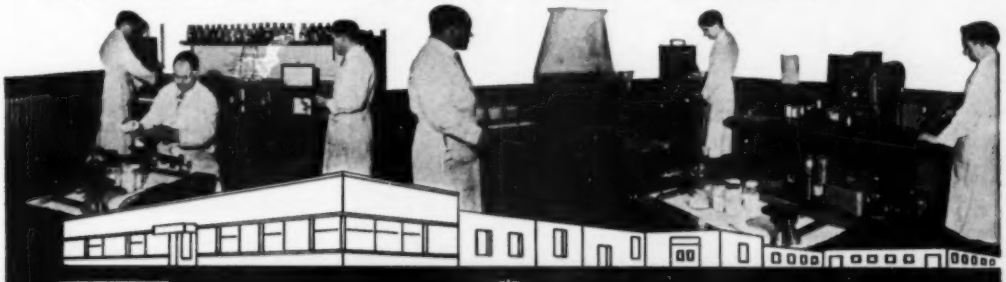
Here's a real opportunity for an aggressive man to earn more money. Well established chemical manufacturer has opening for outstanding sales representatives in the east and midwest. Complete line of alkaline and solvent emulsion type metal cleaners. Knowledge of metal finishing plating, etc. essential. Prefer man with selling experience. Car furnished. State age, previous experience, other qualifications. All replies will be held strictly confidential. Write Cowles Chemical Co., Metal Cleaner Dept., 7016 Euclid Avenue, Cleveland 3, Ohio.



. . . on our Twentieth ANNIVERSARY

we wish you a Very Merry Christmas

Since our birthday, December 7, 1932—as much has happened as in twenty centuries before—it has been an era of great glory, great tragedy and of our greatest industrial and economic expansion . . . . . In our field NORTHWEST has built a very substantial and loyal following because we have learned to do this job of metal cleaning more thoroughly than it was ever done before. . . . . On our Twentieth Anniversary, we want to take this opportunity to thank you for this fine testimonial to our ability to solve such problems and we are going to 'leave no stone unturned' to merit your continued support. . . . . Send for twenty-four page brochure that describes all of the NORTHWEST Chemical products.



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Save time _____
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gives unbelievable uniformity of deposit in recesses . . . brighter, whiter color.

Write for **FREE** *bulletin revealing tricks on improving your nickel plating and cutting costs.*

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Society News

A. S. T. M. 50 Year Index

The A. S. T. M. has announced its release of a "50 Year Index to A. S. T. M. Technical Papers and Reports". This 50 Year Index provides a detailed author and subject index to all the A. S. T. M. technical papers and reports dealing with materials, particularly their properties and testing, appearing in A. S. T. M. publications covering the period from 1898 through 1950.

This Index is intended to make readily available to the materials technologist, the researcher, the librarian, and all others concerned with the fields covered, pertinent information on a particular subject. Copies of this 216-page publication can be procured from A. S. T. M. headquarters, 1916 Race Street, Philadelphia 3, Pa., at $6.00 per copy.

Award of Paper Prize in Britain

The Council of the Institute of Metal Finishing incorporating the Electrodepositors' Technical Society has announced that the Westinghouse Brake & Signal Company, Ltd's prize has been awarded to Mr. W. A. Marchall for his paper on "Non-Electrolytic Treatment for Steel".

At the same time the group also announced that no award of the Johnson Matthey Silver Medal was being made this year, for lack of suitable papers. Papers dealing with any aspect of electrodeposition of precious and rare metals would be eligible for consideration in future awards of the medal.

Institute of Metal Finishing

Birmingham was the venue of the Autumn meeting this year at the Grand Hotel. During the sessions the first Hothersall Memorial Lecture was given by Dr. G. E. Gardam who took as his subject, "A. W. Hothersall—An Appreciation of His Contribution to Electrodeposition." The Hothersall Medal made in palladium, and to be presented annually by the Mond Nickel Company, Ltd., was given to Dr. Gardam during the course of the proceedings.

American Chemical Society

The American Chemical Society recently announced the names of the recipients for 1952 of the eight awards the Society administers. Announced winner of the $1000 Scientific Apparatus Makers Award in Chemical Education which will be presented for the second time at the A. C. S. spring meeting is Dr. Howard J. Lucas, Professor of Chemistry, California Institute of Technology, since 1940. The Award was founded in 1950 to recognize outstanding contribution to chemical education.

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Personals

Alexander N. Braun, founder and former president of the Agate Lacquer Mfg. Company, Inc., has withdrawn from that

Braun

company to organize Braun Organic Finishes, Inc.

As president and general manager, Mr. Braun will supervise the manufacture of quality coatings with special attention to practical innovations and specification finishes.

Carl F. Hansen, Chairman of the Chicago Electro-Platers Institute, presents checks totalling $1,600 to Chicago detectives as a reward for their efforts in arresting and convicting the burglar responsible for many thefts of allocated metals from Chicago plating shops. Shown in the group (l. to r.) are detectives George Haennicke and Al Dean, Hansen, detective Peter Nutley and Austin E. Torney, Institute Legal Counsel. Not present, but also rewarded, was detective John Weston

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Paul E. Kirchartz, formerly Eastern Manager of the Almco Division of Queen Stove Works, Albert Lea, Minn., announces the formation of his own company, Metal Finish, Inc., 410 Frelinghuysen Ave., Newark 5, N. J., for the purpose of engaging in all phases of work in the precision metal finishing field.

His many years of experience in this work, covering not only the sale of chips and compounds, but also the manufacture and distribution of all types of deburring and finishing equipment, qualify him to offer a most efficient service.

E. Gerald Harkins has been appointed as head of the enlarged planning department of the Rubber Products Corporation of Detroit, Division of Automotive Rubber Company, Inc.

Harkins

Harkins, a native Detroiter, is a Public Relations graduate from The University of Detroit and served in the United States Navy.

Sidney D. Kirkpatrick, editorial director of Chemical Engineering and Chemical Week and vice-president and director of editorial development of McGraw-Hill Book Company, Inc., was made an honorary member of the American Institute

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A long and varied list of cost-minded platers have proved the performance of Alsop "Sealed-Disc" Filters. They're getting better finished plated work—they're saving time and labor and their plating solutions last longer.

The "Sealed-Disc" Filter means positive, trouble-free filtration that's proof against costly rejects and reworking—proof against dirt, dust, sludge and even the invisible impurities that cause nodules and porousness. There's a "Sealed-Disc" Filter to "fit your job"—write for complete information or contact your regular plating supplier.

"Sealed-Disc" Filters were designed especially for plating rooms. They're smaller, compact and more portable than ordinary conventional filters, yet they are capable of handling equal volumes of solutions. "Sealed-Disc" Filters are also performing satisfactory results on many acid dips, electro cleaners, and solvents.

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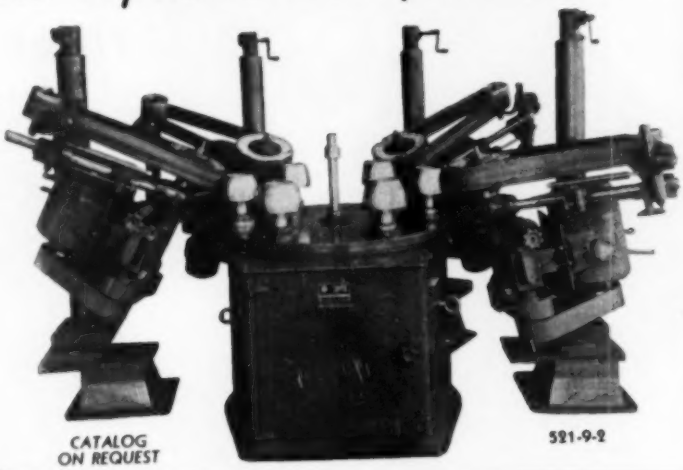
ACME *Automatic* POLISHING and BUFFING

machines are dependable in production!

The ACME Automatic 40" rotary shown here has a six-station indexing table. It is arranged with four ACME type G-1 adjustable floating head buffing lathes equipped with polishing belt arm attachment. ACME Automatic Rotaries are available in indexing table sizes from 18-inch to 10-ft. diameter and up to 24 ft. with continuous tables.



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Federated *M-Sterling Chill-Formed Copper Anodes*, made of 99.9+% high purity copper, assure electrotypers and electroplaters of a uniformly corroding copper anode. Available in all standard sizes and shapes.

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Federated *Zinc Ball Anodes* are cast from special high-grade zinc in 2" paraboloids. Flat and oval zinc anodes are also available with or without full length spine.

Federated *Lead Anodes For Chromium Plating.* For decorative or hard chromium plating. Various alloys of antimonial lead and tin lead available in standard sizes and shapes.

Federated *Conducta-Core Lead Anodes.* Special type lead anodes with high conductivity. Rugged aluminum core construction assures rigidity.

FEDERATED ANODES

Federated *Tin Anodes*, made only from selected grade A prime tin. Available in 2" diameter; in 2" x 3¾" ovals in any length, with or without spines; also in special sizes and shapes with or without spine through entire length.

Federated *Cadmium Anodes*, made in 2" balls, and in 1½" x 2½" ovals with spine through entire length. CADMIUM OXIDE also available.

Federated *Tin-Lead Anodes* are available in ovals and in other shapes to order. Used by electrotypers as a direct substitute for tin foil; by bearing manufacturers; and as a protective coating.

Federated, first in the non-ferrous field, is a prime producer of top quality anode products and anode service.

Federated Metals Division

AMERICAN SMELTING AND REFINING COMPANY • 120 BROADWAY, NEW YORK 5, N. Y.

Personals

of Chemists at a recent meeting of the New York chapter of the Institute.

Presentation of the award was made by **Dr. Lincoln T. Work**, president of the American Institute of Chemists.

Henry W. Willard has been appointed factory manager of United States Rubber Company's Passaic (N. J.) plant, succeeding **William C. Bowker** who retired September 30. Mr. Willard started with United States Rubber Company in 1929, and since then has held a wide variety of positions.

He is a graduate of Cornell University, and while with the United States Air Force, attained the rank of lieutenant colonel on active duty in the Southwest Pacific Theatre.

William A. Hopkins has recently been named general sales manager of Bart-Messing Corporation of Belleville, N. J.

Hopkins

Since 1934 Mr. Hopkins has been identified with many phases of the electroplating industry. After studying metallurgical engineering at the University of Cincinnati, he was employed as a plating engineer with the Electric Auto-Lite Company until 1945. During World War II he was associated with Kellex Corporation in work on the Manhattan Project. After 1945 he was associated with Continental Die Casting Corporation as plant manager, Gerity-Michigan Corporation as technical director and until recently the McGean Chemical Company as Detroit-area sales manager.

William M. Clossey has been elected Secretary and Treasurer by the board of directors of Cowles Chemical Company, Cleveland, Ohio.

Clossey

Mr. Clossey was Secretary and Treasurer of Broadhead Garrett Company in Cleveland just prior to joining Cowles and before that was a supervising accountant for Ernst & Ernst. He is a member of the Ohio Society of Certified Public Accountants.

Obituaries

‡ **Russell O. Warner**, a member of the Syracuse Branch, A. E. S., and staff assistant to the President of the Easy Washing Machine Corporation, died on October 31, 1952 after undergoing surgery.

Mr. Warner had been in the plating field for 30 years, having started with the Brewer-Titchener Corporation at Binghamton, N. Y. He entered the employ of the Easy firm in Syracuse in 1925 as a foreman in the finishing department.

Survivors are his wife, a son, and a brother in California.

‡ The many friends of **Charles H. Eldridge** will be saddened to learn of his death on October 10. Mr. Eldridge, or "Charlie" as he was affectionately known to his innumerable friends, started his interesting career in plating with the Chile Exploration Company where he worked with Dr. Colin G. Fink. He assisted Dr. Fink in the early research which led to the establishment of chromium plating as a practical, commercial plating process.

Mr. Eldridge directed the operation of the first job plating shop for chromium plating, the Center Street Plant of the Chemical Treatment Company in New York City. From New York, in 1926, he went to Detroit as Technical Director of the newly founded General Chromium Corporation, and later was active in the research and service work of United Chromium, Incorporated, until his retirement in 1951.

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CAN SELL
THESE
BRIGHTENERS

as well as a trial in your own plant!

Write today for a specially priced trial order of the ARP Brighteners for any zinc or cadmium plating solution. Or see your Iridite Representative.

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HS is an anhydrous, silicated, heavy-duty tank and barrel cleaner of medium alkalinity. It is formulated to give maximum cleaner life with extraordinarily heavy soil loads. It contains no soaps . . . is free rinsing and produces no undesirable foams on wash and rinse tank solutions. HS allows separation of the oil and removal of such oil from the detergent environment when an overflow principle is used. HS is particularly recommended wherever production specifications demand large amounts of oil removed from in-process parts. Write for complete information.

Prompt shipments from convenient warehouse stocks.

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METAL CLEANER DEPARTMENT
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COWLES TECHNICAL SERVICE
also furnished upon request

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A 1419.

Trade Literature

L—914. High Speed Nickel Plating—A reprint by the International Nickel Company, Inc., 67 Wall St., New York 5, N. Y., consists of 8 pages, 10 illustrations and charts and gives the results of investigations of plating deposits of .001 inch to .003 inch in eleven minutes (at current densities of 100 to 300 amperes per square foot). Deposits exhibited equal corrosion resistance and compared in smoothness, buffing and mechanical characteristics with deposits from a Watts-type bath. Plating solutions and procedures are given. For your copy use Reader Service Card.

L—915. Copper-Oxide Rectifier Stacks—A new 8-page, two-color booklet describing the basic characteristics and applications of copper-oxide rectifier stacks has been announced as available from the General Electric Company, Schenectady 5, N. Y.

Designated as GEA-5699A, the booklet is complete with charts, graphs, and tables illustrating the characteristics, manufacture, circuit design, and application of copper-oxide rectifiers. For your copy use Reader Service Card.

L—916. Tygon Corrosion-Resistant Linings—The U. S. Stoneware Company, 60 E. 42nd St., New York 17, N. Y., has just released bulletin TL-526 on "Tygon Corrosion-Resistant Linings".

This 12-page, 2-color, fully illustrated bulletin presents the complete history of Tygon as a lining and covering material. It discusses Tygon's composition, physical forms, physical properties, where and how to apply it. Extensive tables give a thorough picture of Tygon's chemical resistance. Comparisons with various types of lining materials are made. Methods of preparation, application, maintenance and repair of mechanical damages are also presented. Readers can obtain copies by using Reader Service Card.

L—917. Booklet on Kalamazoo—Hammond Machinery Builders, Inc. (Hammond of Kalamazoo) has issued an unusual booklet entitled "Life Is Good in Kalamazoo" in celebration of its 70th Anniversary. It tells so relatively little about the Company's past, or in fact, about its products, and so much about Kalamazoo in text and picture, that it is suggested that it will prove interesting to any reader regardless of whether he is engaged in management, engineering, production or advertising or, in fact, no matter what he does. For your copy of this interesting booklet use Reader Service Card.

L—918. Phosphate Coating Chemicals and Processes—A new general folder on protective coatings has been issued by American Chemical Paint Company, Ambler, Pa. It describes the entire line of ACP phosphate coating chemicals for paint-bonding, rust proofing, protecting friction surfaces and improving cold forming. For your copy use Reader Service Card.

L—919. Finishes for Aluminum—Reynolds Metals "Technical Advisor" No. 19, just published, carries the concluding section of a two-part article explaining in easily understood language the reason why metals corrode. Cathodic protection, which makes it possible to reduce or entirely prevent corrosion, is also explained.

The current issue of the "Technical Advisor" issued by Reynolds Metals Company, 2500 S. Third St., Louisville 1, Ky., also carries the first article in a new series on "Finishes for Aluminum", taken from Reynolds technical manual on this subject.

The question-and-answer section in this issue covers a number of subjects including cleaning architectural aluminum surfaces, alloy recommendations for aluminum castings contacting nitric acid, and sodium bisulfite; an explanation of why certain welds turn black and how to prevent it; a new black finish for aluminum; and use of stainless steel bolts for aluminum cable clamps. For your copy of this current release use Reader Service Card.

L—920. The Purification of Plating and Other Solutions—"Purification of Metal Salt Solutions with Hydrogen Peroxide" is the title of bulletin No. 26 issued recently by the Buffalo Electro-Chemical Company, Inc., Station B, Buffalo, N. Y., which gives complete directions for isolating metal salts from process solutions. Among the several purposes outlined for this process is the purification of electrolytic nickel-plating solutions with hydrogen peroxide. Use of this oxidizing agent

EXTRA HIGH QUALITY 99.7+% PURE

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Our plant is modern; beautifully equipped; operated by men who are proud of the product they make.

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You can get a quick, unequivocal "Yes" or "No" on your Chromic Acid requirements from interested owner-principals who value your business.

We have yet to have a legitimate complaint on the quality of B.F.C. Chromic Acid. Its chemical analysis is as fine as its physical appearance!

One Price. One Standard of Quality and Service to all—whether the market is short or long. Distributor Stocks in many Principal Cities.

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THEY'RE MICCROSOL COATED

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MICCROSOL E-1003 Heat-Cured Rack Coating is a 100% solids, non-evaporating material that produces a smooth, tough, leather-like coating which will often outlast the rack. Exceptional adhesion is achieved through the use of our primers.

In addition to the outstanding characteristics listed above, tests for abrasion and resistance to all commonly used plating solutions, acids, and caustics show superior performance in comparison to similar products. MICCROSOL E-1003 has proven to excell as a coating for materials-handling equipment, baskets, hangers, and a wide variety of plating equipment parts.

MICCROSOL E-1003 has an exceptionally high gloss, allowing free drainage, and no solution carry-over.

We will be pleased to help you with your coating problems. Send us full particulars.

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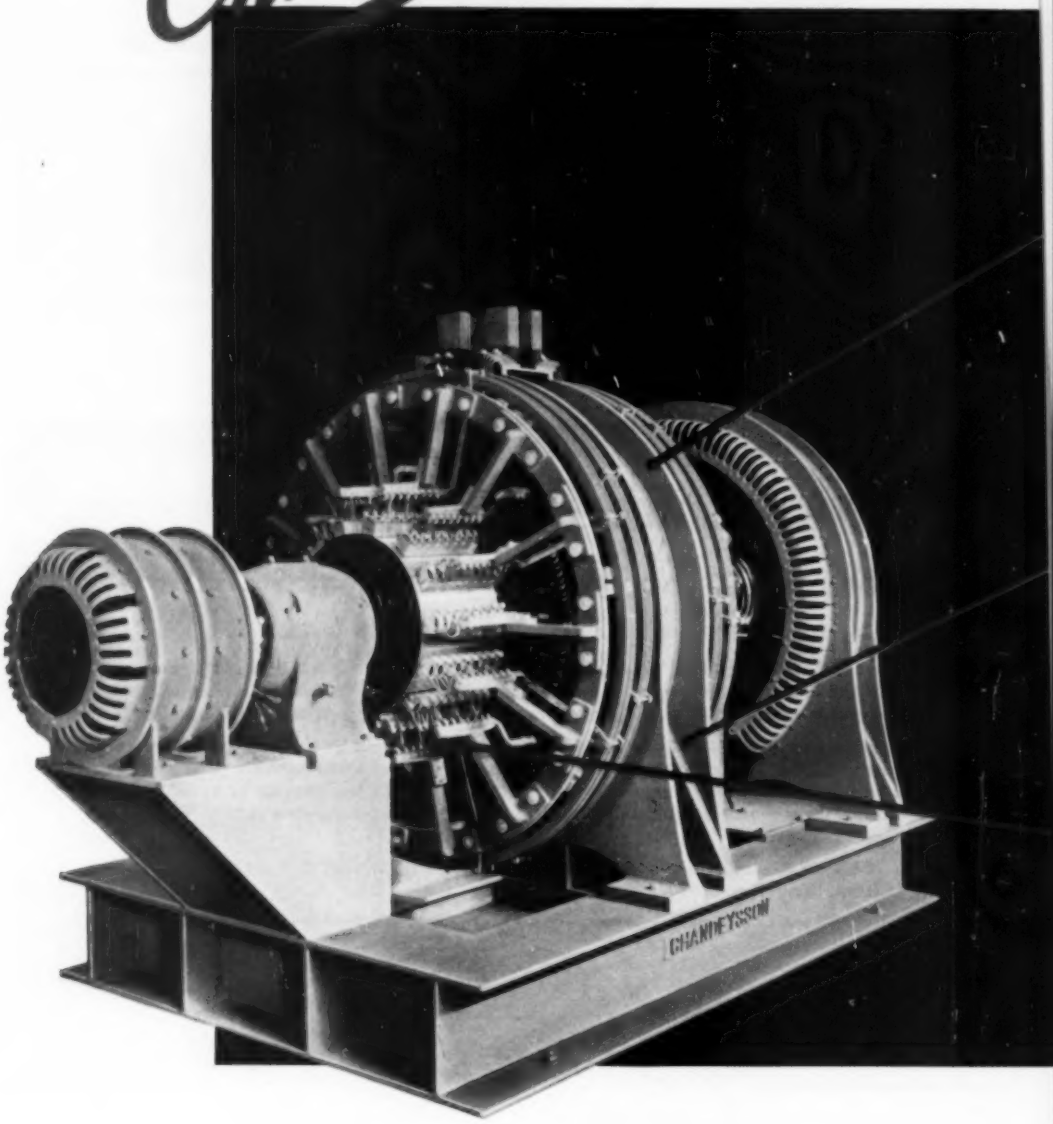
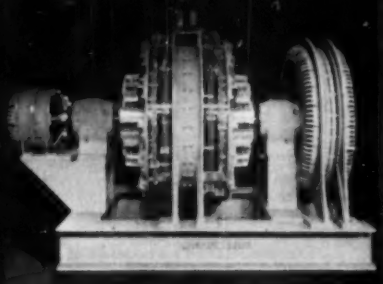
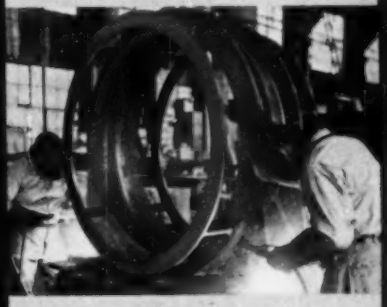


● This all-new Chandeysson motor-generator set rated at 10,000 amps—12 volt—25° C has an overall efficiency of 85% plus.

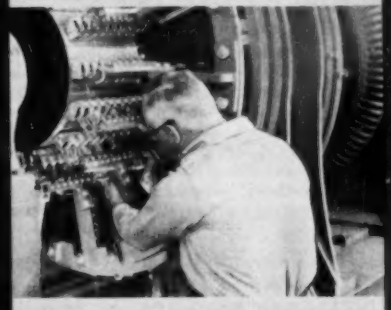
. an ALL-NEW MOTOR-GENERATOR!



● Unrestricted air flow for higher efficiency



● Modern all-welded steel construction



● Completely and easily accessible

Chandeysson's newest motor-generator again sets the pace for industry.

Chandeysson has led in designing and building line generators for over 50 years. Previous contributions pioneered the development of low-speed generators using synchronous motors, two-bearing construction and other features which have become standard today.

The new unit features all-welded steel construction for strength, accessibility and higher efficiency. Brushes, coils and commutator are completely and easily accessible.

Chandeysson motor-generator sets are available for reasonably quick delivery. Write today.

Important! SEE PAGE 1375

Chandeysson ELECTRIC COMPANY

4084 BINGHAM AVE. • ST. LOUIS 16, MO.

Trade Literature

in enameling will so increase the effectiveness of filtering equipment that the nickel bath can be operated for several months without interference from accumulated sludge.

The bulletin gives complete directions for isolating metal salts from process solutions used for the following purposes: Electrolytic Nickel Plating; Beryllium Production; Magnesium Production; Phosphatizing; Optical Glass Production containing Lanthanum Salts; and Tin Recovery from Non-Ferrous scrap. For your copy of bulletin No. 26 use Reader Service Card.

L—921. Complete Vacuum Processing Systems—A 12-page bulletin by the F. J. Stokes Machine Company, Tabor Road, Philadelphia 20, Pa., illustrates and briefly describes vacuum processing equipment as mechanical elements of chemical processing. Included are dryers, impregnators, metallizing units, extraction and solvent recovery apparatus and pumping systems. For your copy of catalog No. 715 use Reader Service Card.

L—922. Liquid Thiokol Bulletin—Thiokol, LP-2 is a viscous liquid which converts to a tough, resilient, solvent-resistant rubber at room temperature. A colorful folder issued by the Thiokol Corporation, 784 N. Clinton Ave., Trenton, N. J., describing the properties and suggested applications of this material is now available. For your copy use Reader Service Card.

L—923. Booklet on Indestructible Plastic—New York Belting & Packing Company, 1 Market St., Passaic, N. J., has just issued a booklet describing its "Indestructible" plastic, which is available as pipe moldings, extrusions, or fabrications. Toughness and high impact strength are achieved in products made of this plastic without sacrificing stiffness, and finished articles or components can be supplied.

"Indestructible" plastic products are now being used successfully, in many forms, in such processing industries, as: chemicals, steel and wire, electrical, mining, and gas and fuel. The new booklet may be obtained by using Reader Service Card.

L—924. Aluminum Bright Dip Bulletin—Kaynide Division of Kraft Chemical Company, Inc., 917 W. 18th St., Chicago 8, Ill., have issued a bulletin detailing operating instructions and data for their Alchemize Aluminum Bright Dip process. Listed are outstanding operating characteristics of the process, solution preparation, recommended treatment cycle and equipment requirements. For your copy of this informative bulletin use Reader Service Card.

L—925. Temperature Recorder Bulletin—Bulletin 447, just issued by The Foxboro Company, Foxboro, Mass., contains complete details of temperature recorder construction, showing how each component part, from bulb to chart, contributes to recorder accuracy. Its 20 pages provide factual information, assisting in the understanding, selection and use of temperature measuring instruments. For your copy use Reader Service Card.

L—926. Rolock Catalog on Fabricated Alloys—Rolock, Incorporated, Fairfield, Conn., manufacturer of equipment for heat treating and finishing of metal parts, has issued a new catalog, No. B-9.

It describes and pictures baskets, racks, crates, tanks, sinks and special equipment for degreasing, cleaning, dipping, galvanizing, pickling, quenching, and other processing operations. Every type of basket, centrifugal, trunnion, drop-bottom, rotating (manual and motor-driven) is shown, including many unusual shapes and designs for specific duties. For your copy of the catalog use Reader Service Card.

L—927. Sheet Metal Fabrication Facilities Described—A new "Sheet and Plate Fabrication" brochure has been issued by The Kirk & Blum Manufacturing Company, 3187 Farrer St., Cincinnati 9, Ohio. It contains over 40 pages of illustrations of the Kirk & Blum fabricating plant and manufacturing facilities. The booklet also gives a comprehensive view of many of the typical parts and products the firm regularly manufactures. Copies of the catalog are available on request. Use Reader Service Card.

PRECLEAN the Dip-Rinse Way!

WHY PRECLEAN?

Even if you do not finish work by plating or vitreous enameling, it is important that you get a metal surface free of solid dirt as well as oil and grease. Subsequent metal forming operations... final painting and other finishes... require a physically clean surface for efficient operations. In such cases, precleaning by the Magnus Emulso-Dip Method becomes the one and final cleaning operation. If you plate or enamel your work, precleaning by this method vastly improves the speed and quality of your final cleaning operation for a chemically clean surface. The Emulso-Dip Method removes dirts which resist virtually all other methods of cleaning.

There is a simple, sure-fire way to get physically clean metal surfaces . . . ANY metal surfaces . . . ready for subsequent metal-working operations, painting or final cleaning before plating. It is as simple as the words "dip-rinse" indicate.

Remove ALL the Dirt . . . Solid as well as Soluble Oil and Grease

It's the Magnus Emulso-Dip Method. Work to be precleaned is dipped into (or sprayed with) a solution made up of one part Magnusol concentrate with four to eight parts petroleum solvent. This solution rapidly wets and penetrates dirt deposits, loosening the bond between all dirt elements and the metal. Then the work is flushed off with water, steam or safety solvent. Oil and grease AND solid dirt—chips, abrasives and other insoluble matter—are flushed away, leaving completely physically clean metal surfaces.

Safe . . . Sure . . . and VERY Economical

The Magnusol cleaning solution is non-toxic, non-flammable, harmless to the skin and safe for ALL metals. Above all, it provides thorough cleaning at the lowest possible cost . . . in materials as well as man-power.

Ask for a demonstration . . . either in your own plant or in the Magnus Pilot Laboratory.

MAGNUS CHEMICAL CO. • 41 South Ave., Garwood, N. J.
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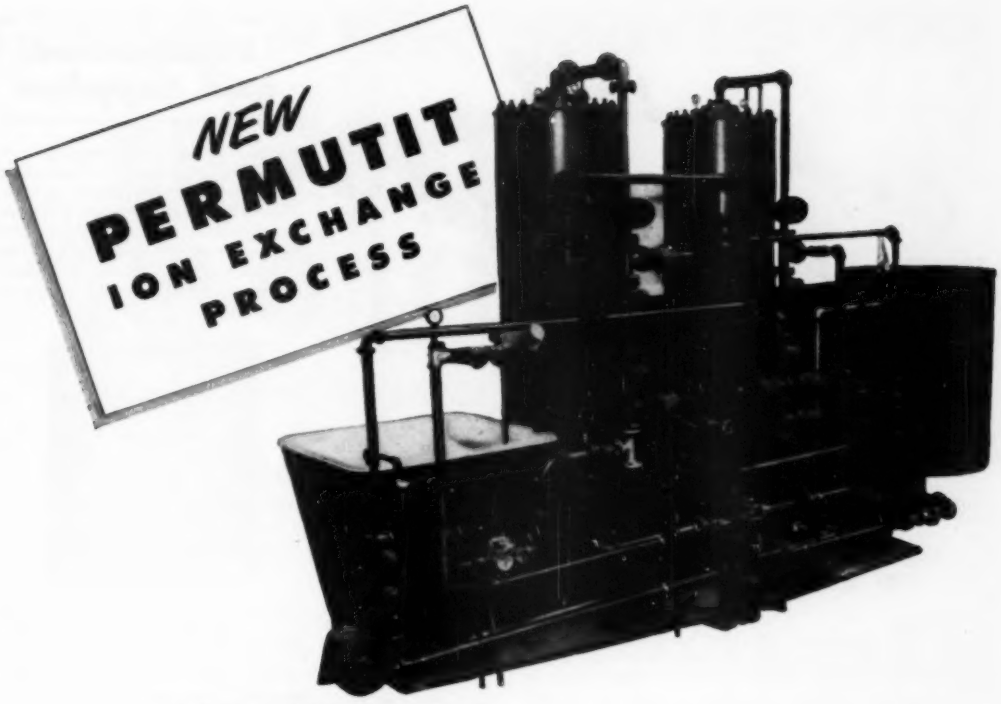
Magnus
CLEANERS • EQUIPMENT • METHODS



- *Saves 80% floor space*
- *Recovers valuable metals*
- *Reduces rinse water heating costs*
- *Reduces stream contamination problems*

Chromate wastes have always represented an operating loss. Anodizing, electroplating, bright dipping, etc., have traditionally sent valuable metallic ions and acid down the drain. Now, you can stop this enormous waste — and also *eliminate* stream pollution — by installing the NEW Permutit ion-exchange process for chromic acid recovery.

Ion exchange is the *only* recognized method of treating electroplating rinse waters to render them non-toxic and to recover significant quantities of valuable metals for re-use. It reduces water consumption and heat loss by recycling the rinse waters.

This NEW process holds the metallic impurities to a low level. It increases the electrical efficiency and eliminates the necessity for dumping the bath at intervals or alternately employing excessive drag-out to limit the metal content. The apparatus uses 80% less space than ordinary waste-accumulation tanks — saving in area, investment and maintenance costs.

Permutit's process is equally adaptable to all other metal treatment applications where chromates are employed, including brass etching, copper stripping, conversion coatings.

For full details, write to THE PERMUTIT COMPANY, DEPT. PL-12, 330 WEST 42ND STREET, NEW YORK 36, N. Y. or to Permutit Company of Canada, Ltd., 6975 Jeanne Mance Street, Montreal.

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SPARKLER FILTERS • SPARKLER FILTERS

Can you afford to buy a low-priced plating filter?

In many instances the first cost of a Sparkler filter will exceed that of some other types of plating filters.

But the savings in operating cost soon will more than make up for the difference, and you will find your Sparkler a good investment both on the basis of cost and quality of performance.

For example:

★ Pre-coating Sparkler horizontal filter plates requires only about one-third the amount of filter aid used by some other filters.

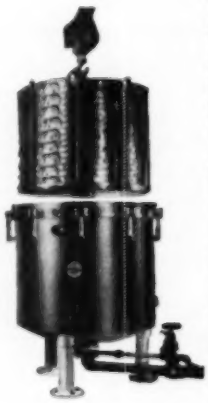
★ Only a thin pre-coat is necessary, and you can get brilliant sharp clarity right from the start.

★ Intermittent operation of the filter will not break up the cake on horizontal plates. No renewal of pre-coating is necessary after a period of inactivity.

★ A wide range of fineness of filter media is possible with Sparkler filters.

★ Sparkler filters are ideal for alloy plating solutions. Non-metallic filter plates and rubber lined tanks are available when required.

These are a few of the many operating advantages that make Sparkler plating filters the most economical in labor and material cost and most satisfactory from a standpoint of filtering quality.



An extra set of plates that can be changed in a matter of minutes cuts "down-time" to a minimum.

Sparkler representatives in all principal cities are available for personal service on your filtering problems.

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Mundelein, Illinois

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Sparkler Western Hemisphere Corp.
Mundelein, Ill., U.S.A.

SPARKLER FILTERS • SPARKLER FILTERS

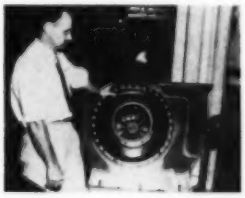
Equipment and Supplies

E—100. Semi-Portable Degreaser—A new Detrex VS Jr degreaser is announced by Detrex Corporation, Detroit 32, Mich. This highly efficient, compact unit is designed to clean small and medium sized parts and is ideally suited for shops, laboratories and small manufacturing plants where production up to 600 pounds of steel per hour must be degreased.

Two standard, manually operated models of the VS Jr are available. One is electrically heated, the other operates by steam. Both degreasers may be easily relocated at any time in various work areas as long as service facilities are available.

The VS Jr is extremely economical. It is low in initial cost as well as in operating and maintenance cost. Installation is simple and inexpensive. For additional information use Reader Service Card.

E—101. Lucoflex Ventilating Fan—Large industrial ventilating fans are now being made entirely of Lucoflex, the unplasticized, hard polyvinyl chloride material by Tech-Industry Services, 19 W.



44th St., New York 36, N. Y. Even the blades are made of Lucoflex, and its operation is as efficient as a metal fan. Since the plastic material resists chemical fumes of all types, the life of the fan in electroplating and chemical plants is many times that of metal units. The plastic fan is lightweight, durable and requires a minimum of support when installed. For additional information on this or other applications of Lucoflex use Reader Service Card.

For Brilliant Zinc Plating...Without Bright Dipping

DU PONT "ZIN-O-LYTE"

ZINC PLATING CHEMICALS

Here's the way to high-quality zinc plating at low cost. With "Zin-O-Lyte" Plating Salts, blue-white rust-resistant deposits of extreme brightness are obtained directly from the bath—*without bright dipping!*

"ZIN-O-LYTE" ZINC PLATING BATHS are easily made up from prepared salts . . . have excellent operating efficiency at both high and low current densities. Economical to maintain, these baths are suitable for all types of zinc plating, particularly barrel plating. Brilliant zinc deposits can be produced on a wide variety of articles of all shapes and sizes.

WHATEVER YOUR PLATING REQUIREMENTS, you'll find that "Zin-O-Lyte" zinc plating chemicals can improve efficiency . . . save time and labor costs over any plating range. Here, as in plating operations of all types, Du Pont plating chemicals offer you highest quality at lowest possible cost.

For Expert Advice and Technical Assistance . . . Du Pont Technical Service

A call to our nearest district office will bring prompt, practical advice from experienced technicians in the plating field. They'll be glad to discuss your specific problems with you and make "on the spot" recommendations to help you increase plating efficiency.

For further information and literature on Du Pont Plating Chemicals, send in the coupon below. E. I. du Pont de Nemours & Co. (Inc.), Electrochemicals Department, Wilmington 98, Delaware.

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Please send me complete information on Du Pont Plating Chemicals—properties, advantages and recommended procedures. I am interested in the following types of plating:

☐ **Cadmium Plating** ☐ **Tin Plating**
☐ **Copper Plating** ☐ **Zinc Plating**

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ARE YOU THINKING *how:*

TO MECHANIZE your plating operations at a minimum cost?

THE ANSWER may be our overhead hoist transfer system mounted on a crane or monorail.

◆

We will gladly furnish detailed information for your particular requirements.

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POLISHING AND PLATING EQUIPMENT

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Chromic Acid

QUALITY . . . SERVICE

Buyers of DIAMOND Chromic Acid are assured of uniform high quality, along with Technical Service help in solving any plating room problems in connection with its use.

Should you need either Chromic Acid or technical assistance, please get in touch with the nearest DIAMOND Sales Office.

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Philadelphia 2, Pa.

Cincinnati, Ohio
525 Walnut St.
Cincinnati 2, Ohio

St. Louis, Missouri
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Pittsburgh, Pa.
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Memphis 3, Tenn.

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Houston 2, Texas

DIAMOND ALKALI COMPANY

DIAMOND ALKALI COMPANY • CLEVELAND 14, OHIO

DIAMOND ALKALI CHEMICALS

Equipment and Supplies

E—102. Permanent Magnet Kit—A "You-Try-It" kit of permanent magnets is being marketed by the Carboloy Department of General Electric Company, Detroit 32, Mich., to enable industrial planners to devise their own new uses for permanent magnets within their own plants.

Permanent magnets have already found a wide use in such various applications as recovering tools from liquid tanks, feeding sheet metals into presses, holding steel plates for painting, affixing models on plant layouts, and picking metallic waste from conveyor lines.

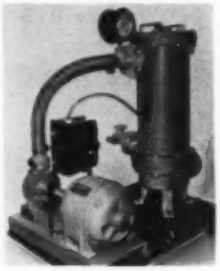
Two kits are available. One contains 48 permanent magnets in eight styles that have up to two pounds of "pull" for each unit. The other contains 18 larger magnets, in four different styles that have a "pull" of from three to twelve pounds. Descriptive literature regarding the kit is available. Use Reader Service Card.

E—103. New Alkaline Procedure for Oxide Removal from Copper Alloys—The removal of oxides from the surface of copper and copper alloys that have been subjected to high temperatures is a serious problem to industry. Cupric oxide dissolves rather readily in most cases but cuprous oxide, which is red in color, is attacked by various acid reagents only very slowly. Because of this, industry has employed for years oxidizing acid mixtures that undermine the base copper to free the oxide rather than employing a chemical that will dissolve the oxide itself.

A procedure developed by Enthone, Inc., 442 Elm St., New Haven, Conn., eliminates the use of acids and the preferential attack on the base metal. The procedure involves converting the cuprous oxide to cupric oxide by the use of Enthone's Ebonol "C" Process. The black cupric oxide that is formed by the use of the Ebonol "C" treatment is easily removed by means of dilute acids, such as dilute sulfuric acid or by sodium cyanide.

Full details regarding the procedure can be secured by using Reader Service Card.

E—104. Sethco Filter Pumps—RLS Series—Sethco, 70-78 Willoughby St., Brooklyn 1, N. Y., announces its most recent addition to a line of corrosion resistant filtering equipment, the RLS Series.



Two models RLS-1200 rated at 1000 to 1500 gallons per hour and RLS-2400 rated at 2000 to 2500 gallons per hour are designed and constructed to produce sparkling clear filtration of practically any acid or alkaline solution from *p*H 1 to *p*H 14.

Two recent developments incorporated in the new designs are self-priming turbine pumps and automatic controls which include magnetic starter, stainless steel pressure switch and stainless bourdon gage. Set up is such that motor stops automatically when the filter assembly becomes loaded with impurities. For additional information use Reader Service Card.

E—105. Selenium Rectifier DC Power Supply—Rapid Electric Company, 2881 Middletown Rd., New York 61, has announced a new line of selenium rectifier power supplies designed for installation at individual work stations. Each of the two models currently in production, a 300-watt unit and a 500-watt unit, operates from a 115-volt 60 cycle-line, and furnishes from 90 to 135 volts of filtered d.c. output.

Each unit is exceptionally light, compact, and easy to install. The steel case may be mounted on a bench or on the wall. For additional information use Reader Service Card.

E—106. "Teflon" Conveyor Belting—The Fabrics Division of the duPont Company has announced the appointment of Voss Belting & Specialty Company, 5649

THE New Year is soon to begin. The Magnuson folks wish a successful and prosperous future to friends and customers, all and everywhere.

We desire to express our gratification, at this time, of serving you in past years. We value your loyalty. We have enjoyed the pleasant business relationship, and we shall make every effort to maintain this desirable status in the days that lie ahead.

MAGNUSON
PRODUCTS CORPORATION
Brooklyn 2, N. Y.
In Canada: Canadian Permag Products Ltd., Montreal

SARCO electric temperature control

ACCURACY AND SENSITIVITY BY SIMPLE ELECTRICAL MEANS

"Very successful in our operation, and I specify them on all our new equipment," says Thomas Allison, Plant Engineer of Southern Gravure Service, Louisville, Ky. ***(See photo at left)***

IN HIS CASE the operation is plating, an industry in which SARCO electric controls have found wide adoption.

There are many others: For example, dryers in the textile, tanning, food and chemical industries; dyeing and wet finishing processes in textiles; processing, distilling and evaporating in chemical plants.

SARCO's complete line includes also thermostats and solenoid or motor valves for space heating, air conditioning and refrigeration control.

Get the whole story by writing for bulletins 1025 and 1080.

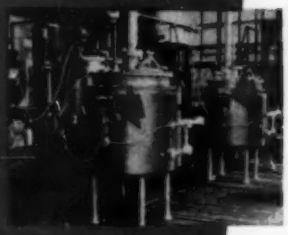
SARCO COMPANY, INC.
EMPIRE STATE BUILDING, NEW YORK 1, N. Y.
SARCO CANADA LTD., TORONTO 8, ONTARIO
REPRESENTED IN PRINCIPAL CITIES

PLATING

In copper and chromium plating of rotogravure rolls, the temperature of plating solutions is held to within ½°F by Sarco Electric Indicating Temperature Controllers. Photo taken in Southern Gravure Service plant, Louisville, Ky.

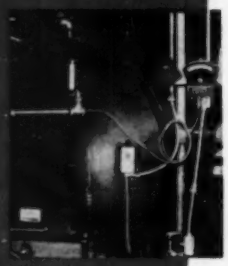
CHEMICAL

Hoffman La Roche Pharmaceutical Co., Nutley, N. J.—the jacket water temperature of these stills must be held to within ½°F. For the past 9 years, Sarco LSI Indicating Temperature Controllers have been doing that job.



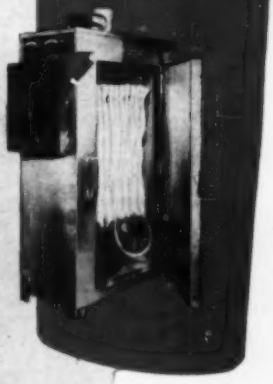
FOOD

Chocolate milk and soft drinks in bottles and cans are processed in Fort Wayne Sterilizers. Many users equip these Sterilizers with Sarco LSI Electric Indicating Controllers to hold the temperature to within ½°F. Hook-up sketches and case histories on request.



TEXTILE

The Backus Hosiery Conditioner processes 15 denier nylon hosiery—60 dozen per 1 hour cycle. The humidity and dry heat are controlled by two Sarco Electric Indicating Temperature Controllers. Over 500 LSI's have been factory-installed on these Conditioners by Backus Machine Works, Carlstadt, N. J.

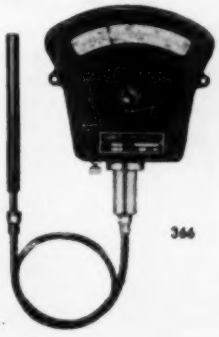


TYPE LSI

An extremely sensitive and accurate Electric Indicating Temperature Controller for temperatures from minus 90°F to plus 650°F. Controls electric heating elements, motors, solenoid or motor valves to maintain constant temperature.

A built-in thermometer makes setting easy and provides a continuous check on temperatures maintained without the bother of continually changing charts.

A double switch type L2SI is available for alternate heating and cooling control, or step control of heating or cooling.



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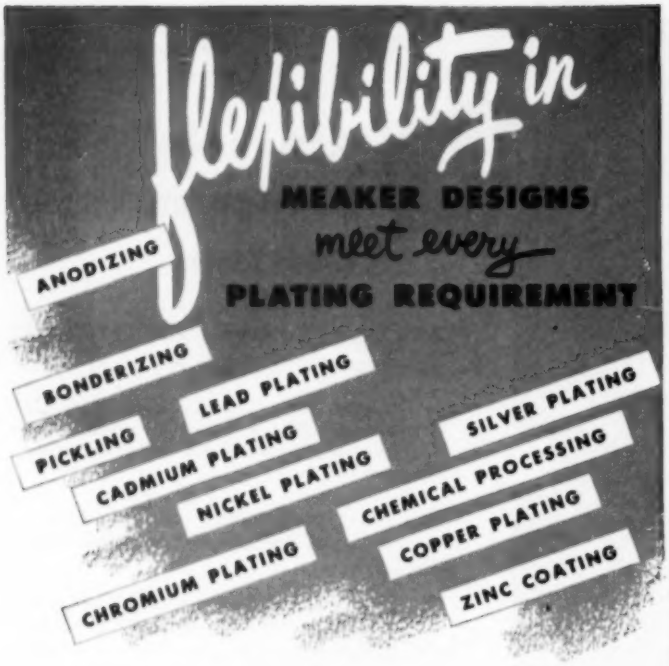
Mechanized handling in the different sequences is the basis of profitable production plating. In the MEAKER designs of automatic plating machines this handling is flexible so that adjustments and modifications are easily made to meet practically every plating requirement. Too, the simple rugged construction insures uninterrupted schedules and minimum maintenance costs.

Get full particulars to meet your plating requirements from The Meaker Company, 1639 South 55th Avenue, Chicago 50, Illinois.

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- Full Automatic and Semi-Automatic Electroplating Equipment
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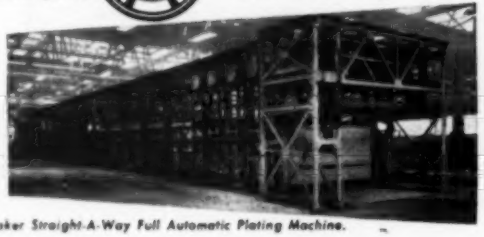


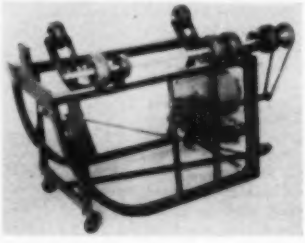
A Meaker Straight-A-Way Full Automatic Plating Machine.

Equipment and Supplies

N. Ravenswood Ave., Chicago, as the first distributor of "Teflon" coated glass fabrics in the form of Conveyor Belting. Voss Belting will distribute "Teflon" Belting on a national basis.

The "Teflon" coating is unaffected by almost all known chemicals; it has exceptional resistance to both high and low temperatures; it is non-sticking to a remarkable degree; and the coated fabric as a whole is exceptionally resistant to wear. Chemical concerns, certain types of metal workers and numerous others have been looking for just such a material to solve a variety of pressing conveying and handling problems. For additional data use Reader Service Card.

E—107. Portable Drum Rotator—Structural improvements in the Model No. 200 Portable Drum Rotator have been announced by the Morse Manufacturing Company of Syracuse, N. Y. De-



signed to agitate or mix drum contents up to 500 lbs in 30 to 55 gal drums, the rotator has been strengthened by a second horizontal steel brace which gives additional support to the idler wheels. The position of the drive motor has been reversed to allow the idler reduction sprockets to be located inside the framework of the unit. For additional information use Reader Service Card.

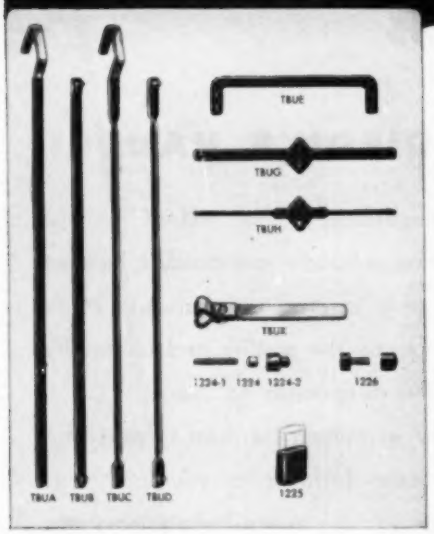
E—108. Low-Cost Vapor Degreaser—Known as the "Drum Major", an inexpensive vapor degreaser using a readily replaceable standard 55-gal steel drum for the cleaning tank is now in production by Currier Company, 710 73rd Ave., Oakland 4, Calif.

The unit uses any of the modern vapor solvents for rapid degreasing and cleaning. Condenser and heating units are externally mounted. After long use, solvent can be recovered from accumulated sludge by simple distillation utilizing the unit's own condenser.

Thermostatic controls automatically maintain correct vapor level. No water connections are required; installation merely requires plugging in to a 220 v., 60 cycle a.c. power source. Elements are

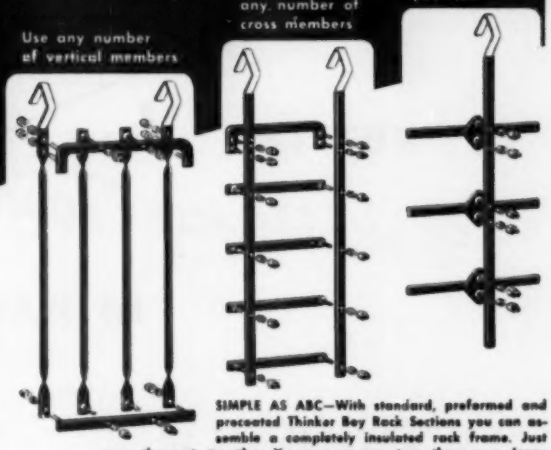
Why Thinker Boy Racks are a Permanent Investment . . .

. . . instead of a Heavy Rack Expense



Part No.	Lengths (overall)
TBUA	24, 30, 36"
TBUB	6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 30, 36"
TBUC	24, 30, 36"
TBUD	10, 12, 14, 16, 18, 20, 22, 24, 30, 36"
TBUE	6, 8, 10, 12, 14, 16, 18, 20, 22, 24"
TBUG	10, 12, 14, 16, 18, 20"
TBUH	10, 12, 14, 16, 18, 20"
TBUK	Attachable Handle—Clamps on cathode hook
1224	Tapered Stainless Steel Nut
1224-1	Stainless Steel Stud
1224-2	Plastic Cover Cap
1226	Plastic Plug for unused holes
1225	Boot—Used to cover end of sectional member when cut

Send for bulletin illustrating the great variety of BELKE Removable Tips for Thinker Boy Racks.



SIMPLE AS ABC—With standard, preformed and precoated Thinker Boy Rack Sections you can assemble a completely insulated rack frame. Just screw the parts together. You can use one, two, three or a dozen cross members. If the job changes, you can remove as many members as necessary to accommodate the job, or you can use the sections to make racks of entirely different styles. Either way you save money—which makes Thinker Boy a good investment.

A careful buyer looks to the future. When Thinker Boy Racks of one type or style are no longer needed the racks do not become worthless as do other racks. You can use the Thinker Boy Rack Members to make racks of the right style for new jobs and save hundreds of dollars.

With Thinker Boy Racks you avoid messy storage, breakage and costly repairs that are unavoidable with ordinary racks. You can take Thinker Boys apart in minutes for safe storage in small space. *Thinker Boy Sections from racks that would fill the whole ceiling can be stored in a small box.*

Thinker Boy Racks give you *permanent re-use value because they are made of standard, precoated rack sections, equipped with BELKE Vac-Seal fittings and assembled with screws. They need no coating after assembly—you can take them apart by simply removing the nuts.*

New Bulletin shows how to make racks designed with BELKE Thinker Boy Sections. *Send for your copy NOW.*

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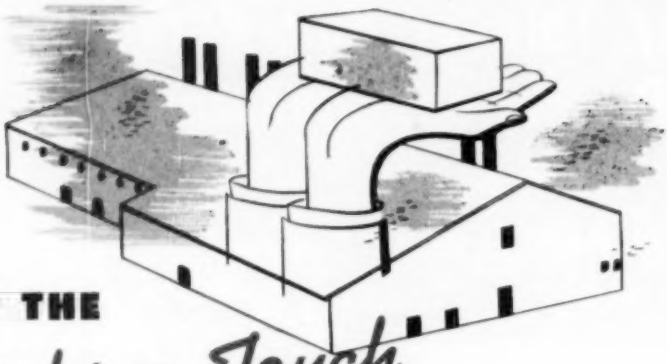
EVERYTHING FOR PLATING PLANTS



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Dear Friend,

Saying "Hello" is always a real pleasure.

It is especially satisfying at this time of the year, when we all take a little time out to think of the full meaning of friendship.

With deepest gratitude for yours, I want to wish you a very merry Christmas, with health, happiness, and prosperity in the year ahead.

Sincerely,

James A. Viola

James A. Viola
President

REMEMBER..... RAPID MEANS "More power to You!"

rated at 3500 watts. Initial solvent charge requires 5 gallons. Drum is supplied with the unit, and may be replaced when necessary with any standard 55 gal drum. Detailed literature may be obtained through use of Reader Service Card.

E—109. Air-Flow Exhaust Hoods—A new development in exhaust hoods for buffing and polishing wheels has been announced by Creative Development & Mfg., Inc., 2222 E. First St., Dayton 3, Ohio.

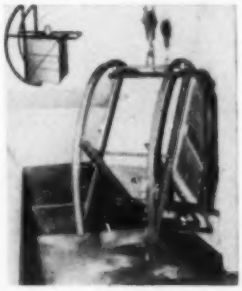
Curved airfoils that can be quickly adjusted close to the surface of the buffing wheel in the hood pick up "wind" created by the revolving wheel, along with particles of metal, dirt and dust that normally follows around with the wheel, and blow it into the exhaust system with considerable velocity. This greatly increases the efficiency of the exhaust system and eliminates polishing dirt from being discharged onto the work and operator and into the plant.

The standard model can be adjusted for wheels up to 16 inches in diameter and 7 inches wide. For additional data use Reader Service Card.

E—110. Combination Fire Extinguisher Cart—For quick, efficient fire-fighting, General Detroit Corporation, 2272 E. Jefferson Ave., Detroit 7, Mich., and the General Pacific Corporation, 1501 E. Washington Blvd., Los Angeles 21, Calif., have designed a Quick-Aid combination fire extinguisher cart equipped with three extinguishers designed to combat all types of fires.

As a mobile unit that is easily wheeled into emergency areas it permits extinguisher action at once. The handy fire dolly includes an extinguisher for fires caused by gasoline, oil, grease, paints and inflammable liquids originating either in open vessels or floor splash fires; another for all types of electrical fires such as those originating in switch boxes, motors, transformers, and generators; and a third with an anti-freeze charge making it practical for inside or outside use on fires caused by wood, paper, textile or rubbish. Complete information and literature on the handy fire dolly is available. Use Reader Service Card.

E—111. Carboy Rocker—Getting the last drop from a carboy, safely and efficiently, is now made possible by the new Morse carboy rocker with emptying attachment. The Morse Manufacturing Company of Syracuse, N. Y., has announced that the attachment allows the carboy rocker to hang from a chain hoist or crane over the vat until emptied. The attachment, with two wheels which run on the rocker parts, has a lock hook which holds the carboy rocker in an upside-down position.



Morse carboy rockers are equipped with wheels to serve as combination trucks and rockers, and will handle conventional size acid carboys. For additional information use Reader Service Card.

E—112. Brady Quik-Masks for Anodized Metals—The W. H. Brady Company, 1640 E. Spring St., Chippewa Falls, Wis., announces the addition of a new line of Quik-Masks developed specifically for use on anodized surfaces.

The material used for these new Brady masks is Minnesota Mining and Manufacturing Company's No. 214 paper masking tape. This tape has recently been developed by 3M to meet the demands of the painting and plating industry for a tape that adheres to anodized surfaces during high temperature baking cycles. It is easily removed after baking.

The principal applications for this new line of Quik-Masks are on anodized aluminum, pickled magnesium, dichromated magnesium and similarly treated metal surfaces. For free samples and literature use Reader Service Card.

Users of Hammond Junior Automatics report 3 to 7 times faster finishing than hand methods. The Operator merely loads and unloads the machine, result . . . . faster, better and more uniform finishing, more pieces per hour with less operator fatigue.

SEND SAMPLES: Send us one finished and several rough samples. You will receive a complete Engineering Report and Production Analysis without obligation.

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Hammond Machinery Builders INC

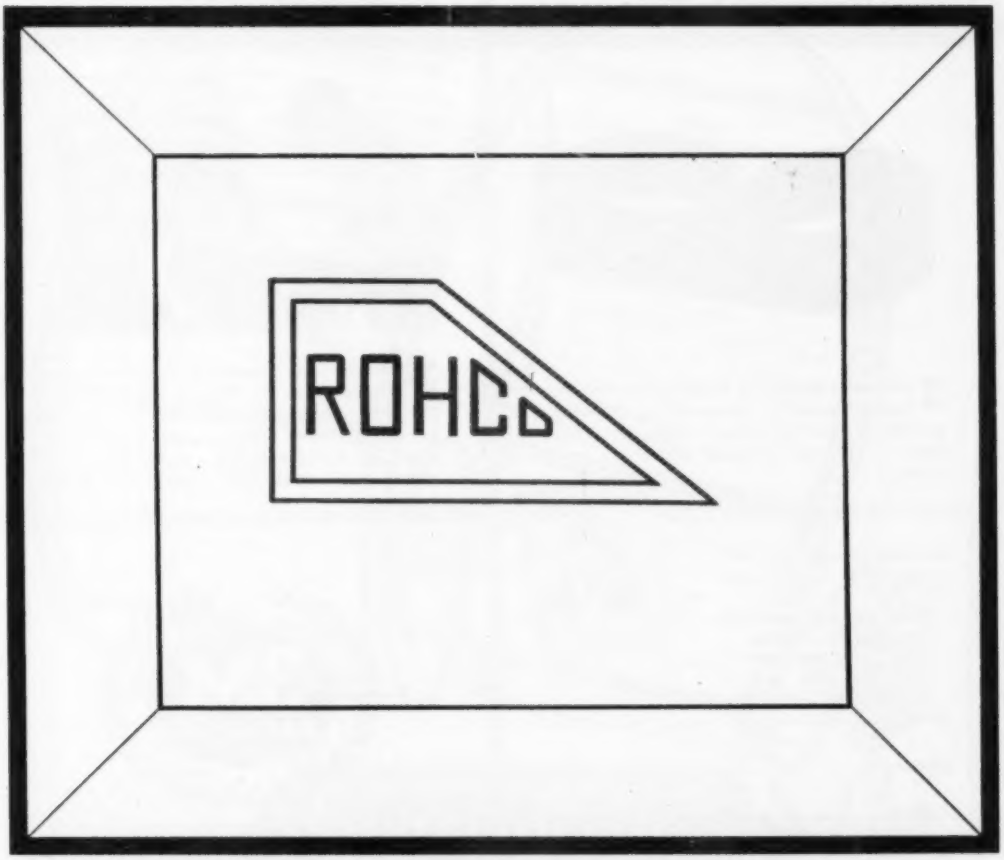
1613 DOUGLAS AVENUE ★ KALAMAZOO, MICHIGAN, U. S. A.

TO THE PLATERS OF AMERICA!

WE thank our many friends and customers for their confidence and good will and pledge our continued efforts toward the betterment of electroplating.

May you have a very Merry Christmas and a Happy and Prosperous New Year.

R O Hull



R. O. HULL & COMPANY, INC.

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Production Problem:

Cut high unit costs of finishing brake shoes for bonding to brake linings.

1 Wagner Electric Corporation, makers of Comax Brake Lining, found ordinary abrasive belts wore out too quickly—finished only about 50 brake shoes per belt. Frequent belt replacement kept abrasive costs at a high $.009 per finished unit.

2 3M Sales Engineers suggested that manufacturer switch to long-wearing 3M Abrasive Belts (Grit No. 3½-20 Production Cloth Open Coat) and a special serrated contact wheel.

3 Results: An *immediate* reduction in abrasive costs for Wagner Electric. Each 3M Belt finished 150 brake shoes—cut costs to only $.003 per finished unit. A 3M representative would welcome an opportunity to survey your operations. Just mail coupon.

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ALL STAR CAST
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. . . FOR BETTER METAL FINISHING

AHCO STAINLESS STEEL BUFFING COMPOUND
All abrasive types and grades. For cutting down and coloring stainless steel. Formulated to meet your specific requirements. Write for Bulletin B-1.

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For polishing and cutting down metals, woods, and plastics . . . for brushed or satin finishes. All grades available. Write for Bulletin B-2.

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For cutting down and coloring all metals. Ideal for fully-automatic buffing machines. Keeps buffs cooler on high-speed runs. Write for Bulletin B-3.

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AHCO CUTTING COMPOUND 17-D-4
For deburring or cutting down steel or iron parts in tumbling barrels. Prepares surfaces for chemical treating or organic finishing. Write for Bulletin B-5.

AHCO WATER DISPLACING COMPOUND
For removing water from metal surfaces. Produces unspotted, dry surface. Oil type for special applications also available. Write for Bulletin B-6.

These products are manufactured under the same rigid laboratory control that has made AHCO Compounds, AHCOLOID Metal Cleaners, and 99% Nucast Nickel Anodes outstanding for uniform high quality wherever metal finishing is performed.

Over a Century of Service

APOTHECARIES HALL CO.

WATERBURY 88 CONN

Our 70th Yuletide Message to Our Customers and Friends

We of Frederic B. Stevens Inc., wish you a most joyous Holiday Season and unbounded good fortune during the coming year.

We wish to thank you for entrusting your business needs to our organization. We are deeply grateful for the loyalty you have shown to us . . . and we are proud to count you among our friends.

So please accept these Holiday Wishes for health, happiness and good fortune . . . and add to them a sincere "Thank You" from all of us at Frederic B. Stevens Inc.

METAL FINISHING EQUIPMENT AND SUPPLIES SINCE 1883

FREDERIC B. **STEVENS** INCORPORATED

DETROIT 16, MICHIGAN

plating

DECEMBER, 1952 VOL. 39, No. 12

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This month's cover is a photo of a rural stream in Sussex County, N. J., taken by Paul Miller of the Bloomfield, N. J., Camera Club.

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PLATING is abstracted regularly in Chemical Abstracts, Metallurgical Abstracts, Engineering Index, Technical Data Digest and Bulletin Analytique.

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best of all-fibrous filtering mediums

- ★ Made of 100% pure fibrous cellulose
- ★ Exact fibre lengths maintained, permitting "sharpness" of filtration
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- ★ Forms easily-cleaned layers which do not "slough-off"
- ★ Provides efficient depth filtration
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- ★ Rapid forming of pre-coat offers tremendous advantages in "setting"
- ★ Eliminates clogging of cloth and screen wires
- ★ Fibrous structure maintains steady flow through the filters
- ★ Especially adapted to low-cost clarification work

NOTE: When Nibri-Cel No. 1 is used, the filter is "set" by using only ½ oz. of material for each square foot of filter surface, rather than the usual 4 oz. per square foot recommended when using diatomaceous earth. Usually no addition of filter material is required on the run.

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SEND ME a large sample of Nibri-Cel No. 1 for testing.

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Editorial

Christmas – 1952

THE RECENT NEWS hinting at successful tests of thermonuclear weapons is an added burden to an already tense world situation. Coming as it does, at the start of another Christmas season, the news adds extra emphasis to the Christmas message of "Peace on Earth". The hopes and joys associated with the season are tempered with thoughts of the new power. The lesson from the story of the Wise Men at the manger, often unheeded, but one which has persisted in the hearts of men through disasters and hostile ideologies may be realized at last, in that man may now have developed a force of such destructive magnitude that it will be an effective deterrent against major armed conflict among nations in the future.

There are sections in the world today, no doubt, where the celebration of the Christmas holiday is not permitted, just as in the past when it was suppressed for a time in Scotland after the Reformation, and when it wasn't allowed in much of New England until the 19th century. However, the messages of hope brought by the story of the Nativity and of cheer brought by its modifications of mistletoe, evergreen trees, turkey, eggnog and Santa Claus have not been and will not be dimmed through the centuries. Merry Christmas!

Al Korbelak

Metal Recovery by Ion Exchange

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ONE OF THE FIELDS in which ion exchange holds the most promise is the recovery of metals. In a vast number and variety of manufacturing processes, dilute solutions are produced containing metals whose recovery would be most attractive.

We commonly think of metals as cations when in solution, and it was logical for the first attempts to be made using cation exchangers. However, some of the most important and valuable metals are also frequently present as anions. Table I illustrates some of the forms in which industrially important metals are present in solution. This list is by no means exhaustive, but the cases given are typical, and will be expanded upon to show the different methods of attack.

Metal Recovery from Acid Solution

The examples of acid plant wastes containing small quantities of metals are too numerous to mention. However, a large and typical one is zinc in the waste from rayon plants. Zinc sulfate in an acid solution containing large quantities of sulfuric acid and sodium sulfate is used to coagulate the cellulose strands to form rayon, and when this solution is rinsed from the rayon, a large volume of dilute solution is produced. Mindler has reported[1] on tests using a sulfonated cross-linked polystyrene resin. Many of the earlier types of cation exchangers had been investigated unsuccessfully for this purpose. They would not remove metals in the presence of hydrogen ions. The capacities at various acid concentrations when treating solutions containing 500 ppm zinc are shown in Table II. It can be seen that the capacity falls as the acid concentration rises. These data show the capacity to a point where 50 ppm of zinc appears in the effluent. At higher acid concentrations than 1 per cent, the slippage of zinc rose and the capacity fell.

Using customary regeneration techniques it would be possible to recover solutions containing several per cent of zinc. However, if a much stronger solution can be recycled into the manufacturing process, special regeneration techniques may be resorted to. The countercurrent principle in a modified form is used to extract the zinc from the cation exchanger at the most useful concentration. Several regenerant segments are passed through the cation exchanger in order of decreasing zinc concentration and increasing acid concentration. To achieve highest capacity, the final segment must be a strong sulfuric acid solution, and to achieve high regenerant effluent zinc concentration, many segments must be used.

Metal Recovery from Anionic Complex by Cation Exchange

A novel application of cation exchange to metal recovery has been reported[1]. In tin plating from alkaline baths, the rinse water contains recoverable amounts of tin as sodium stannate. A sulfonated cross-linked polystyrene resin in the hydrogen cycle was employed to treat such a rinse solution. Hydrogen ions were exchanged for the sodium, causing reduction in *p*H and precipitation of metastannic acid. The tin-bearing solution was sent through the bed upflow at a rate sufficient to fluidize the bed. This prevented clogging of the voids in the bed by the precipitate. Formation of an insoluble end product drove the reaction to completion, and the very satisfactory capacity of 1400 meq/l was obtained. Sludge filtration in a conical vessel was employed on the effluent solution to concentrate the sludge. The overflow from this unit was water at a *p*H of 3.0 containing 30 ppm of sodium and no trace of tin. This water could be neutralized and used for further rinsing, being of better quality than most plant waters, and since the entire process was conducted at elevated temperatures, the heat in the rinse water was conserved.

The precipitate drawn from the bottom of the sludge unit could be dissolved in strong hot caustic to yield a solution satisfactory as makeup to a tin plating bath.

Recovery of Cationic Complex by Cation Exchange

In the cuprammonium rayon industry vast quantities of copper-bearing water are produced from rinsing the filaments. Most of this water is quite alkaline and contains Cu probably as the tetramine, NH_4, Na, SO_4, and small quantities of other ions. Recovery of the copper in Germany by cation exchange has been reported[2] and a similar process is in operation in this country. Since the quantity of copper is quite low, and the amount of suspended material may be appreciable, the flow rate is high and the use of a high capacity synthetic resin is not indicated. A sulfonated

TABLE I.—TYPICAL METALS SUITABLE FOR RECOVERY BY ION EXCHANGE

	Cation	Anion
Acid Solution	Copper, zinc in rayon plant wastes Copper, nickel, zinc, lead in acid mine waters and acid plating wastes	Chromic acid in anodizing, etc. $[FeCl_4]^-$
Neutral Solutions	Many plating wastes	Chromate salts
Alkaline Solutions	Copper amine in rayon plant wastes	Stannate salts in electroplating Gold and silver cyanides in plating and ore refining Silver thiosulfate in photographic wastes

coal is used, and at the high *p*H, its carboxylic acid and phenolic groups come into play giving a capacity in the neighborhood of 750 meq/l of copper. The copper is taken up eventually as the diamine, and since this is held very strongly by the exchanger, the other cations, present in considerable excess compared to the copper, pass through. The copper is then regenerated with 4 per cent sulfuric acid. The acid solution containing copper sulfate may be readily recycled into the process, but if the need arose, concentration along the same lines as described for zinc could be performed.

Recovery of Chromium by Cation Exchange

The processes mentioned above for copper and zinc can be applied very well to the recovery of cationic chromium. However, relatively little of the chromium which is produced by metal treating processes is initially present as the chromic cation. Chromium is generally used as chromic acid in such processes as electroplating, etching, anodizing, copper stripping, brightening after electroplating other metals, etc. In these processes, the acid rapidly becomes contaminated with metallic cations and must be discarded. Costa has described[3] a prolonged series of tests on the removal of interfering cations from chromic acid so that the baths may be reused. This process makes use of one of the outstanding characteristics of the sulfonated polystyrene cation exchange resins, their resistance to oxidation. There have been published[4,5,6] a number of papers on treating brass and copper mill wastes by ion exchange but they almost all found that if hexavalent chromium were present, both the cation and anion exchangers were oxidized and lost their effectiveness. However, the polystyrene cation exchangers are resistant to chromic acid up to 15 per cent and have an excellent capacity for metallic cations in any solution of lower concentration.

In practice the method is best applied to anodizing baths, where approximately one pound of aluminum is dissolved for each pound that goes into the oxide coating on the metal, and hard chrome plating baths where the prolonged contact of the strong acid solution with the plated surface causes some of the cationic metal to go into solution. By withdrawing each day a portion of this bath and treating it by cation exchange, the bath may be permanently maintained at the point of maximum coating efficiency. Former practice was to allow the metal content to build up to a point where the coating was adversely affected and then dump a portion of the bath and refill with fresh CrO_3. This created a very serious waste disposal problem and was expensive.

Chromium Recovery by Anion Exchange

An extension of the process described above has been developed recently. After a chromic acid treatment, it is customary to rinse excess acid from the metal. There are many ways of operating rinsing facilities with one or more flowing rinses occasionally preceded by a still rinse. But in most cases a solution must eventually be disposed of which contains from 10 to 100 ppm of chromate anion. A new anion exchanger, Permutit S, is resistant to attack by such solutions and will adsorb the chromate anion. The rinse water may then be recirculated. The Permutit S is then regenerated with sodium hydroxide and the regenerant effluent sent back to the anodizing tank through a cation exchange resin which forms the free acid. In plant scale operations this process has been

TABLE II.—CAPACITY OF PERMUTIT Q FOR ZINC

% H_2SO_4	Total Capacity meq/l	Capacity meq/l to 10% breakthrough	Zinc Leakage ppm
0.05		1430	2
0.1		1320	3
0.5		1040	20
1.0		830	15
1.5	643		100
3.0	308		155
5.0	115		254

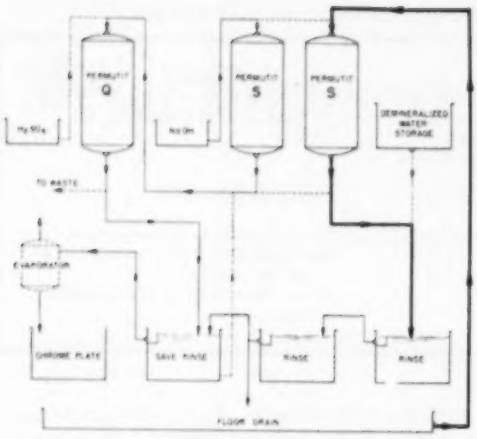

Fig. 1. Chromate Recovery Equipment

shown to be profitable. Fig. 1 shows this equipment. The process conserves the chromic acid, rinse water, and heat in the rinse water and eliminates a serious waste disposal problem. It costs less than the purchase of an equivalent quantity of chromic acid. In anodizing operations, it has also been shown to yield a more corrosion resistant coating.

Removal of Metals from Acids by Anion Exchange

An interesting type of recovery has been reported by Kraus and Moore[7]. They find that many metals customarily considered to be present in solution as cations are present as anions in acid solution, actually probably as coordination compounds with the acid. Such compounds as $Fe(PO_4)_4^{-}$, $FeCl_4^{-}$, and AlF_6^{---} are typical. Even in acid as strong as 9 N hydrochloric, these anions may readily be held by highly basic anion exchangers. Kraus and Moore have applied their efforts chiefly to separations of hafnium, columbium, tantalum, protoactinium, and zirconium, but have demonstrated the ready manner in which metals which form coordination compounds can be separated from those which do not. The process has been applied successfully in several locations for the removal of traces of iron from muriatic acid.

Precious Metal Recovery by Anion Exchange

Recovery of gold and silver from ore and electroplating wastes can be accomplished by anion exchange. In these solutions the precious metal is generally present in alkaline solution as the cyanide complex. Conditions here are somewhat different than in previous situations discussed as the very dilute form in which the precious metals are present results in low capacity. Also, the complex precious metal anions are only regenerated off the anion exchanger with difficulty. Efforts are being directed toward development of special anion exchangers for precious metals and effective special regeneration procedures have been developed.

Anion exchange has also been attempted to recover gold from ore. Hussey has reported[8] a series of investigations along this line. Customary extraction processes depend upon the percolation of a cyanide solution through the finely ground ore. However, an increasing number of ore bodies being worked contain the gold mixed with clays and other minerals which form slimes and prevent percolation. An anion exchanger may be mixed with the ore during leaching. The anion exchanger holds the metal cyanide as it is dissolved allowing complete leaching of the ore. The granular exchanger may then be filtered from the slime and regenerated with caustic. Special ion exchange equipment has been developed for this purpose.

Recovery of Electroplating Wastes

To show how some of these techniques may be combined to solve a difficult disposal problem, we will consider a plant doing chromium plating on top of nickel and copper. Fig. 2 shows the flow plan of such a plant and how ion exchange might be incorporated. For simplification only one rinse is shown after each step except chromium plating, but more rinses might be necessary. The material to be plated is cleaned, plated with copper from a cyanide bath, plated with nickel from a sulfate bath, and plated with chromium from a chromic acid bath, with rinses between each of the steps. Various recovery methods including ion ex-

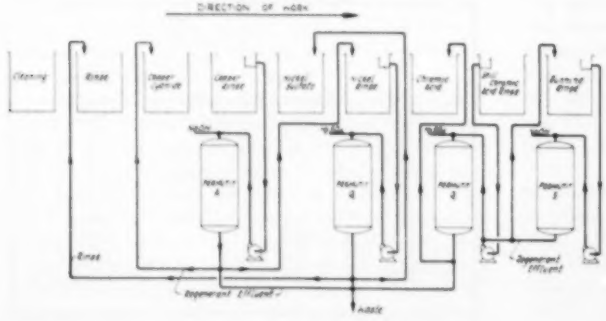

Fig. 2. Plating Recovery Flow Sheet

TABLE III. ANALYSIS OF HYPOTHETICAL PLATING CYCLE WASTE EFFLUENT

Rinse	Copper	Nickel	Chromium
Flow gph	2000	2000	2000
Analysis—ppm—Cu	8	Ni 22 CrO_3	10
Na	12	SO_4 30 Cr^{+++}	1
CN	14	Cl 3	
Weight per day—lb as metal	3.2	8.78	1.36
Value in solution—$/day	$3.18	$5.70	$0.92

change have been proposed for such a system, but they almost all were based upon treatment of the mixed wastes and yielded some, if not all of the metal values in forms which were difficult to recycle to the system. A typical system might involve reduction of chromate, neutralization of the chromic cation and precipitation with lime, and oxidation of the cyanide with chlorine.

As analyses of individual wastes from such plants are rather hard to locate, and generally vary from time to time to such a degree as to be unreliable, the analyses in Table III have been assumed.

Demineralized water is used for making up all the baths and the copper rinse. The copper rinse, containing the copper as a complex anion, is pumped from the overflow of the rinse tank through a bed of a highly basic anion exchanger such as Permutit A which will hold the cyanide, and copper complex. The effluent of this unit will contain hydroxide equivalent to the anions removed and the run will be halted when cyanide breaks through. Part of this water will be recycled and the remainder will go to the nickel rinse bath. The highly basic anion exchanger will be regenerated with caustic soda and the regenerant effluent which will be highly alkaline will be returned to the plating bath. Regeneration rinse waters and any other waters which might contain cyanides can be given a chlorine treatment to insure freedom from toxicity and used to neutralize the acid rinse waters.

Rinse water from the nickel rinse will go to the bed of sulfonated cross-linked polystyrene resin such as Permutit Q where the nickel will be removed. At the low *p*H, little if any of the sodium will be held. The effluent from this unit can be recycled to another bath where traces of sodium sulfate would not be harmful. Upon regeneration with sulfuric acid, this cation exchanger will yield a solution containing 2 per cent Ni and 2 per cent free H_2SO_4 which can be returned to the plating bath. The excess acidity may have to be lowered by dissolving nickel carbonate in the regenerant effluent before addition to the bath.

The chromate recovery system will be a completely closed system. Fig. 3 shows such an ion exchange system. The concentration of chromate in the still rinse will be allowed to rise to about 10 per cent. At frequent intervals this still rinse will be passed through a cation exchange unit to remove metallic cations, and occasionally part of the treated acid will be returned to the plating tank. It may be necessary to use an evaporator to concentrate this solution although experience in many locations has indicated that a 10 per cent solution may be returned directly. While the dragout from the plating rinse contains some metallic cations, the dragout from the still rinse will be almost pure chromic acid. This running rinse will pass through a highly basic styrene base anion exchanger and then be recycled. When this unit is exhausted, it will be regenerated with caustic soda and the regenerant effluent sent through the cation exchange unit for removal of sodium and then to the still rinse tank. Throughout the cycle of the two units working on chromate bearing liquors, it is possible to operate in such a manner that all the liquor containing chromates will go to either the plating bath, still rinse or running rinse and none will go to waste. The regenerant from the cation exchange unit will be sent to waste as it will contain a mixture of metals which would not be worth separating.

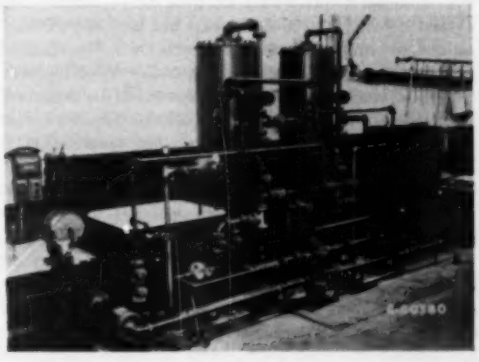

Fig. 3. Closed System Ion Exchange Installation

TABLE IV.—COST COMPARISON OF DISPOSAL AND RECOVERY OF PLATING PLANT WASTES ANALYSES AS SHOWN IN TABLE III

Disposal		Ion Exchange Recovery		
Neutralization with lime	$ 0.36	Copper		
Reduction of CrO_3 with $FeSO_4$	0.22	Regenerant NaOH	$0.72	
Oxidation of CN with Cl_2	3.12	Regenerant NaCN	3.60	
Amortization of Equipment	20.80	Amortization	2.68	
	$24.50		7.00	
		Credit Copper Cyanide	3.18	
				−$3.82
Water Consumed	$14.40	Nickel		
		Regenerant H_2SO_4	0.60	
		Amortization	2.00	
			2.60	
		Credit Nickel Sulfate	5.70	
				$3.10
		Chromium Cation		
		Regenerant H_2SO_4	0.50	
		Amortization	2.00	
			2.50	
		Credit Chromic Acid	9.15	
				$6.65
		Chromium Anion		
		Regenerant NaOH	0.20	
		Regenerant H_2SO_4	0.15	
		Amortization	2.68	
			3.03	
		Credit Chromic Acid	.92	
				−$2.11
		Total Value		$3.82
		Water Consumed		$4.80

Let us examine the savings that such a system would involve. It would be possible to oxidize the cyanides with 7 parts of chlorine per part of cyanide, reduce the chromates with copperas or sulfur dioxide and mix the three rinses and neutralize to precipitate the hydroxides. These hydroxides could be removed by settling or filtration. A conventional disposal house for these solutions would cost not less than $25,000. The sludge from such a unit would contain approximately 5 per cent solids which could be lagooned. It is possible that after settling, the precipitate could be sold for reworking.

Neutralization would require 122 pounds per day of lime, reduction of chromate would require 216 pounds of copperas, and oxidation of cyanide, 39 pounds of chlorine. Table IV shows a rough cost estimate of this process.

To treat the cyanide waste would require 3 cu. ft. per day of anion exchanger. Actually the flow rate would necessitate the use of a larger unit. A satisfactory unit would be 30 inches in diameter and hold 14 cu. ft. of highly basic anion exchanger. Each day the regenerant needed would be 4 pounds per cu. ft. each of caustic soda and sodium cyanide.

The nickel recovery unit would also have to be sized according to flow rate as approximately 4 cu. ft. of styrene base cation exchanger per day would be needed. This unit also would be 30 inches in diameter and would require 40 pounds per day of 66° Bé H_2SO_4.

The chromate recovery anion exchanger would be similar to the copper cyanide unit in size. It would require 5 pounds of caustic soda per day as regenerant. The chromate recovery cation exchanger is difficult to estimate accurately as too many factors are involved but it is assumed that operation would be similar

(*Continued on page 1338*)

Notes on the Electrodeposition of Thick Gold Deposits

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I. Introduction

In connection with a special project, it was necessary to produce in a continuous electroforming operation smooth gold deposits up to a thickness of approximately 0.01 inch (0.25 mm). Efforts to produce this type of deposit by means of the conventional cyanide-gold plating baths were unsuccessful. It was, therefore, necessary to investigate different types of baths and operating conditions. Because time did not permit a systematic study of all the variables that may affect a gold deposit, this brief report is devoted principally to the definition of conditions found to be favorable to the aforesaid objective. A more exhaustive study would be required to define and explain fully the conditions that affect the production of thick gold deposits.

A survey of the literature revealed very little published work on the deposition of thick gold deposits. For ornamental purposes very thin coatings are used, ranging from a few millionths to a few hundred-thousandths of an inch (of the order of $0.1 - 1\ \mu$). In special engineering applications thick deposits are used, e. g., during the war as much as 0.001 inch (0.025 mm) of gold was used on radar equipment. There has been little, if any, demand for much thicker coatings or for electroformed gold objects, and consequently, suitable baths have not been developed. An exception is the gold chloride-hydrochloric acid bath, used principally in gold refining, from which thick, smooth deposits are produced. However, for the electroforming application involved in the present study, the very corrosive action of the chloroauric acid on the stainless steel mandrel and the poor throwing power of the bath eliminated the use of such a bath. It was decided, therefore, that the cyanide bath was the most practical type to be studied.

II. Composition of Plating Bath and Conditions of Plating

On the basis of exploratory studies, a high-concentration gold cyanide bath and conditions of operation were developed, from which deposits 0.006–0.009 inch (0.15–0.23 mm) thick were electroformed in a continuous operation. The composition of the bath and the operating conditions were:

	N	*g/l*	*oz/gal*
Gold	0.09	18	2.2 (troy)
Potassium Cyanide	1.8	120	16
Potassium Hydroxide	0.07	4	0.5
Potassium Sulfite	0.05	4	0.5
Vanillin	....	0.3	0.04

Temperature	80° C (176° F)
Current Density	0.5–2.0 amp/dm² (5–18 amp/ft²)

Pure gold anodes were used. Vigorous agitation obtained from a combination of mandrel rotation and air agitation, was beneficial to the deposit. A cathode efficiency of nearly 100 per cent was obtained. The conditions and composition were carefully controlled during the plating operation.

At its peak of performance the bath gave smooth deposits up to 0.015 inch (0.38 mm) thick, which did not have the coarsely crystalline appearance that was characteristic of thick gold deposits obtained from many other combinations of composition and operating conditions tried. The life of the bath was limited, for with continued operation the bath produced coarsely crystalline deposits, and "spot-plating" occurred. (The term "spot-plating" is applied to the deposition of the metal only at random places on the cathode surface.) The main reason for the failure of the bath to continue to produce the desired deposits was the increase in the carbonate content of the bath, caused by the decomposition of the free cyanide. Efforts to control the cyanide decomposition were not very successful. One method that was promising was the use of lithium cyanide as a source of cyanide, inasmuch as lithium carbonate precipitates as it forms. The present high cost of lithium salts is a disadvantage of this method.

The effects of changes in concentration of the bath constituents, especially the concentration of gold and cyanide, were studied. In addition, the rate of decomposition of cyanide and the resulting increase in the carbonate content were investigated.

(a) *Gold Concentration*

The various concentrations of gold that were tried gave reproducible results. With very low concentrations, gassing occurred at the cathode except at very

low current densities. Concentrated gold baths were selected for reason of the following advantages: (1) a longer life, because the gold content is depleted during operation under the conditions given, and (2) a higher deposition rate, because the limiting current density may be increased by increasing the gold concentration. The gold was introduced as commercial sodium or potassium gold cyanide. Commercial potassium gold cyanide, containing 67.5 per cent of gold, was generally used, but sodium gold cyanide, which contains 46 per cent of gold, is just as satisfactory. The limiting gold concentration was determined by the solubility of the potassium gold cyanide complex, $KAu(CN)_2$. At the concentration adopted, the gold cyanide complex precipitated when a bath that had been in operation for some time was cooled. This precipitation was probably caused by the formation and accumulation of potassium carbonate in the bath. However, the limited solubility of the gold cyanide complex did not shorten the life of the bath, for the increasing carbonate content made the bath inoperable before the cyanide complex precipitated at the high operating temperature.

(b) *Cyanide Concentration*

The effect of changing the free cyanide concentration was investigated by varying the ratio of cyanide to gold. The results are expressed as the ratio between the molar concentrations of free cyanide and of gold at various gold concentrations. The potassium cyanide concentration was increased from 1.3 to 391 g/l (0.17 to 52.4 oz/gal), and the mole ratios of potassium cyanide to gold ranged from 2:1 to 60:1. Runs of six hours at a current density of 5.4 amp/ft² (0.55 amp/dm²) gave deposits about 0.005 inch (0.13 mm) thick. With low ratios of potassium cyanide to gold, the deposits were coarsely crystalline and treed at the edges, and had a duller appearance than those produced from baths with higher ratios. As the ratio was increased, the deposits became smoother and lost their crystalline appearance. At still higher ratios the deposits were again very coarsely crystalline, and in many cases spot-plating occurred. The best results were obtained with a mole ratio of about 20:1, regardless of the gold concentration used. For any bath the deposits improved as the bath was used, until a peak of performance was reached. As the bath was used further, the crystallinity of the deposits increased and spot-plating occurred. The bath with a ratio of 20:1 and with a concentration of 18 g/l (2.2 troy oz/gal) of gold gave superior deposits over the longest period of time. Under its best operating conditions this bath gave a deposit with a matte finish and no marked crystallinity.

Higher current densities, up to 18 amp/ft² (2 amp/dm²), produced smooth, fine-grained deposits with the 20:1 ratio of potassium cyanide to gold, but whether or not this ratio is optimum at the higher current densities was not determined.

(c) *Cyanide Decomposition and Carbonate Control*

Free cyanide decomposes in hot solutions, particularly at high current densities, and frequent additions of potassium cyanide have to be made to maintain a constant concentration. As the cyanide is decomposed the carbonate content of the bath increases. The decomposition reactions may form: hydrogen cyanide, ammonia, urea, carbonate, formate, and cyanate[1]. Hydroxide, formate, and cyanate ions are intermediate in the formation of carbonate, which is the principal decomposition product.

Because carbonate is the principal decomposition product, a study was made of the effect of increasing the carbonate content in a gold cyanide bath. Potassium carbonate was tried in initial concentrations from 0 to 70 g/l (0 to 9.4 oz/gal) in new baths. A mole ratio of about 2:1 with respect to gold, that is, a concentration of 25 g/l of potassium carbonate in the bath containing 18 g/l (2.2 troy oz/gal) of gold gave the best deposits. With no or very little carbonate, the deposits had a dull appearance. With high concentrations of carbonate, the deposits were very crystalline, similar to those obtained with high concentrations of cyanide. Since carbonate rapidly accumulates in a bath, no initial addition was made in the selected bath.

Methods for controlling the carbonate content of a cyanide bath were studied. The most promising method which could be used on a continuously operating bath and which would introduce no harmful ions was the use of lithium cyanide as a source of cyanide. Lithium cyanide is extremely soluble, whereas lithium carbonate has a low solubility. As the cyanide is decomposed the carbonate formed is precipitated as lithium carbonate. Continuous filtration would remove the precipitated carbonate. The solubility of lithium carbonate in water decreases with the temperature as follows:

Solubility of Li_2CO_3 in Water[2]

Temperature		*Solubility*	
° C	*° F*	*g/l*	*oz/gal*
0	32	15.4	2.1
20	68	13.3	1.8
100	212	7.2	1.0

The solubilities of lithium carbonate in the plating bath would probably be of the same order of magnitude. As stated previously, the desired mole ratio of carbonate to gold is about 2:1. Therefore, in the selected bath, the concentration of carbonate, as lithium carbonate, should be about 13 g/l (1.8 oz/gal). Several determinations of carbonate in operating baths, saturated with respect to lithium carbonate, yielded

(*Continued on page 1338*)

[1] R. M. Wick, "Notes on Cyanide Decomposition", Monthly Rev. Am. Electroplaters' Soc. **20**, No. 10, 10–16 (1933).
[2] Atherton Seidell, "Solubilities of Inorganic and Organic Compounds", Vol. I (D. Van Nostrand Company, Inc., 2nd Ed.), p. 368.

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CORROSION OF IRON AND ITS PREVENTION BY DEPOSITS OF NON-FERROUS METALS

Synopsis of Lecture Presented at Sheffield, on Friday, April 18, 1952

BY DR. U. R. EVANS, F.R.S.

The lecture discussed Corrosion and Protection in connection with the present shortage of metal. If the life of metallic articles could be increased, this would, in the long run, be equivalent to an increase in the supply. There is a danger, however, that, owing to the shortage of the metals used in the elementary state for metallic coats, or in the combined state as pigments in anti-corrosive paints, manufactured articles may be offered for sale, and even exported, in a state in which good service is improbable. The reputation of British goods for reliability may be lost very quickly, if articles are sent abroad insufficiently protected against rusting. The development of the Electrodepositors' Technical Society into the Institute of Metal Finishing may do something to impress manufacturers with the fact that finish is not simply a matter of appearance, but an essential feature of reliable service. A structure, vehicle or machine which rusts should be considered almost as discreditable as one which breaks; rusting, like breaking, is capable of being prevented by suitable protective measures.

Many "practical men" still believe that the rusting of iron is merely a direct chemical union with water and oxygen to give hydrated oxide. It has now been proved to be an electrochemical phenomenon, and the electric currents flowing over the corroding surface are found to correspond, in the sense of Faraday's law, to the corrosion rate. This relationship—which has been established by pure science research—has consequences of great importance to the practical man:

(1) When iron is immersed in salt water, or covered with drops of salt water, soluble products are formed at the anodic and cathodic areas, which interact to give rust in such a way that no impervious film is formed over the surface; attack, therefore, continues unchecked. The cathodic product, sodium hydroxide, is capable of attacking the vehicle of many ordinary paints. Thus paints intended to protect iron from salt water should have vehicles which resist alkali—an important point which would not be expected if rusting were just a union with water and oxygen.

(2) If the composition of water is so adjusted that a sparingly soluble substance would be produced either at the cathode or anode, its power to corrode iron is greatly reduced.

(3) The acid character of the moisture which condenses on iron exposed to the air in urban or industrial districts greatly increases the rate of attack, partly because the acid increases the proportion of soluble matter formed and partly because it aids the cathodic reaction.

(4) If iron is covered up with the discontinuous coating of another metal, being itself exposed at gaps in the coating, the exposed iron may sometimes escape attack. This may occur, for instance, if the coating is strongly anodic to the iron and the water one which deposits sparingly soluble bodies as cathodic products; but the immunity depends on suitable electrochemical conditions, and must not be taken for granted.

(5) Conversely, if the coating is cathodic, the iron exposed at the gap will be attacked, and sometimes (but not invariably) the attack may be more intense than if the whole surface had been left bare.

The Productivity Council Team who recently visited America insert in their report a wise warning against the hasty adoption of "Kerbside" standards, but some of the daily papers which quoted from this report have distorted or omitted the warning. The efficient use of the limited amount of metal available depends on the production of a coating of uniform thickness, unless liability to corrosion is likely to vary from point to point, in which case the thickness may be intentionally varied so as to be greatest where conditions are most severe. Various methods of coating metal differ among themselves in their power to give uniform or intentionally graded deposits. Absence of porosity should be aimed at. For some purposes, the total bare area is more important than the number of pores, and methods are available for estimating that area. Liability to cracking in service is distinct from the porosity of the freshly coated metal, and great care must be taken to minimise dangerous stresses in the deposit.

Gold Deposits

(Continued from page 1336)

concentrations of lithium carbonate in the range of 15 to 18 g/l. Gold deposits from these baths were satisfactory except for roughness, which was probably caused by suspended matter.

(d) *Addition Agents*

Of about thirty addition agents tried, only two showed any improvement in the deposits. These two were vanillin and potassium sulfite. Vanillin in a concentration of 0.3 g/l (0.04 oz/gal) was beneficial. Deposits about 0.005 inch (0.13 mm) thick were much finer grained from a bath to which vanillin had been added than from one in which there was no vanillin. The simultaneous use of both vanillin and potassium sulfite appeared to be advantageous.

III. Analysis of Gold Solutions

In the determination of gold it was found that evaporation of the bath sample with either hydrochloric or nitric acid, as recommended in the literature, did not completely destroy the gold cyanide complex. A yellow precipitate, probably aurous cyanide, was never completely destroyed, even with subsequent evaporation. It was necessary to fume the sample with concentrated sulfuric acid, whereby the cyanide was destroyed and the gold was precipitated as metal. If no impurity such as silica or iron was present, the gold was precipitated quantitatively and in a compact form, which could be filtered out, washed, ignited, and weighed.

Since it was usually necessary to remove traces of silica and iron, the longer procedure outlined below was used. Details for the final precipitation of the gold are given by Gilchrist[1].

1. A sample from the bath was evaporated with sulfuric acid to the appearance of dense white fumes.
2. The residue was treated with aqua regia, diluted, and filtered to remove silica.
3. The filtrate was evaporated almost to dryness, the residue was dissolved in water, and the *p*H was adjusted to 1.5 by adding sodium hydroxide, using thymol blue as an indicator.
4. The solution from 3 was heated and potassium nitrite was added to precipitate the gold.
5. The gold was filtered, washed with dilute hydrochloric acid to remove iron, washed with water, ignited, and weighed.

Standard methods were used to determine cyanide and carbonate.

Acknowledgment

Acknowledgment is made to Vernon A. Lamb for advice and assistance in this investigation.

[1]Raleigh Gilchrist, "New Procedure for the Analysis of Dental Gold Alloys", J. Research, National Bureau of Standards, **20**, 745 (1938).

Ion Exchange

(Continued from page 1334)

to what was found in a chromic acid anodizing plant where the sizes of anion and cation exchangers are similar. Twenty pounds of sulfuric acid are used as regenerant for this unit. One extra regeneration would be required to take care of anion regenerant so this unit would operate 2 cycles per seven days.

As on any day only one ion exchange unit would require regeneration and this would require little attention, no cost for labor has been included.

In estimating the value of the recovered materials, the market prices of the chemical in solution is used. Thus the value of the copper may seem rather high. Since chromium plating baths are more concentrated than most others, dragout is more serious. Probably if ion exchange were not used for this recovery, some other means of minimizing this loss would be utilized, so the value of chromate recovered is somewhat high. A cost balance indicates a saving of $3.82 per day over no waste treatment or of $28.32 over a conventional system. This saving would pay for the equipment in 300 working days. Also, since most of the water is reclaimed and reused, the water cost will be reduced from $14.40 to $4.80 per day.

Recirculating Rinse Water

In many locations plating tank and piping layouts are such that individual rinse solutions cannot be isolated for recovery of the valuable constituents. Here also ion exchange can be profitably employed in the waste disposal scheme. Rather than conventional waste holding tanks and chemical feeders, it is possible to demineralize the entire waste stream, at an equipment cost comparable to the tanks and feeders, to produce a high quality water for all plant processes. The ion exchangers in the demineralization step may be regenerated when exhausted to yield only a small volume of concentrated waste which may readily be rendered non-toxic by conventional means. Such a process offers major economies in labor, and of course the demineralized water results in freedom from staining and water spots of the finished work, freedom from sludges in the baths and dull, pitted, blistered, or brittle deposits. Frequently the cost of treatment for such recycled water is less than the cost for treating the plant raw water to make it suitable for plating operations.

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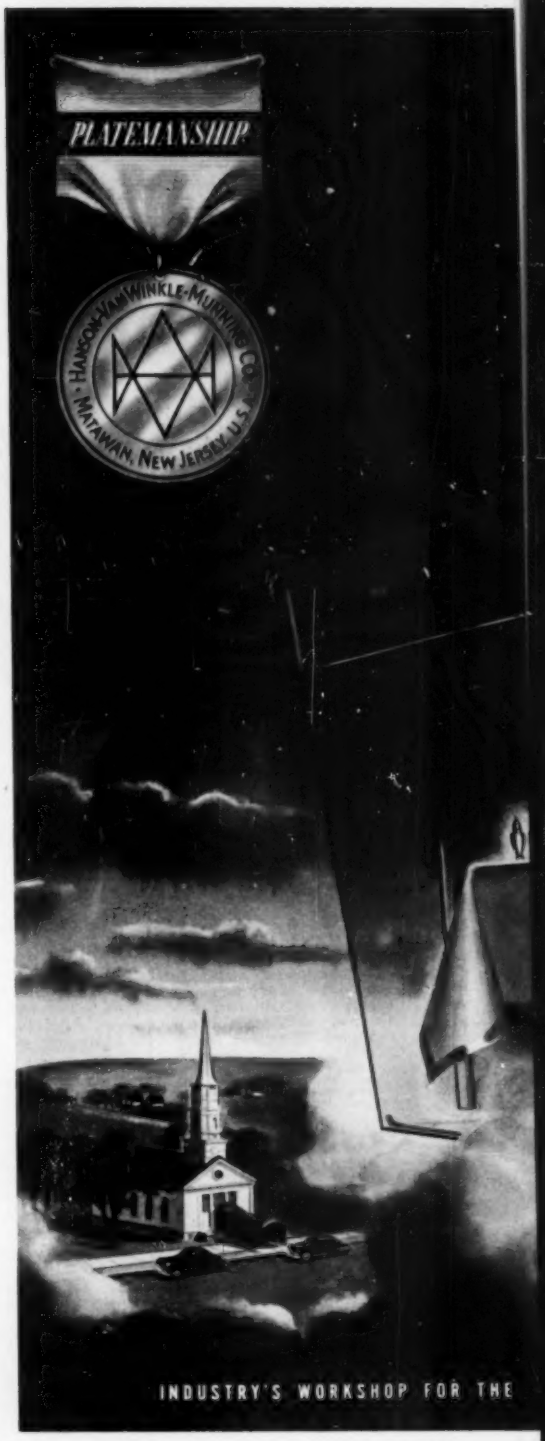

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*AUTHORS

Effect of Impurities and Purification of Electroplating Solutions

I. NICKEL SOLUTIONS

6. THE EFFECTS AND REMOVAL OF IRON

This paper is the sixth of a series on the effects of impurities and the purification of solutions for the electrodeposition of nickel.

The effects of iron as an impurity in four types of nickel plating solutions have been investigated and data are presented which indicate the accompanying changes in certain physical properties of the electrolytic nickel. Previous studies by other investigators into the effects of iron as an impurity were reviewed in an earlier publication[1]. Since the results of an independent investigation concerning the behavior of iron in solutions for the electrolytic deposition of nickel indicated that the iron in solution was predominantly in the divalent state and that under 10 per cent of the total iron present was in the form of ferric ions[2], the iron was added to the nickel solutions in the form of $FeSO_4 \cdot 7H_2O$ to give the following concentrations of iron: 2.5, 10, 25, 50, 100 and 200 ppm. The different solutions studied were the Watts type at *p*H 2.2 and 5.2, an alloy type at *p*H 3.75 containing a moderate amount of cobalt and an organic type solution at *p*H 3.2 containing organic compounds as brightening agents.

Six physical properties of the electrolytic nickel were investigated, namely: appearance, adherence, ductility, hardness, salt spray corrosion resistance and throwing power. A purified bath free of iron was selected as a standard solution. The change in the physical properties of the deposits was evaluated as the concentration of the iron impurity in solution was increased. In most cases, the results have been reported as per cent change from the properties exhibited by the deposits obtained from the corresponding standard solutions. Hence, the graphs and tables presented indicate changes and trends rather than absolute values for each of the four general types of solutions.

The rate of removal of iron from nickel plating solutions has been studied. The removal methods investigated were high *p*H precipitation and low current density electrolysis.

Experimental

A. Preparation of Deposits and Evaluation of Physical Properties

The methods of preparation and purification of solutions, preparation of deposits and subsequent testings of these deposits were those described in a previous publication[3] with the following modifications. The vertical portion of the steel cathode that is subjected to electrodeposition was reduced from 2 x 3.5 inches (5.1 x 8.9 cm) to 2 x 3 inches (5.1 x 7.6 cm). This was necessitated by a reduction in the overall length of the sheet steel cathodes that were made available for this investigation. The nickel-cobalt type solution was operated at a temperature of 140° F (60° C), rather than 131° F (55° C), resulting in decided improvement in the

TABLE I. EFFECT OF IRON ON THE APPEARANCE OF NICKEL DEPOSITS

Iron Concentration mg/l*	Bath Type			
	Watts *p*H 2.2	Watts *p*H 5.2	Nickel-Cobalt *p*H 3.75	Organic *p*H 3.2
0	2†	2†	mirror bright	mirror bright
2.5	1–2	1.5–2	mirror bright	mirror bright
10	1–2	1.5–2	mirror bright	mirror bright
25	1–2	1.5–2	mirror bright	mirror bright
50	1–2	1.5–2	mirror bright	mirror bright
100	1–2	1.5–2	mirror bright	mirror bright
200	1–2	1.5	mirror bright	mirror bright

*1 mg/l = 1 ppm = 0.00013 oz/gal

†Step of Eastman Gray Scale

appearance of the deposit. It was also found necessary to employ nickel plated steel cathodes rather than the ordinary steel cathodes during the low current density electrolytic removal of iron from the nickel solutions. If this precaution were not observed, it was found that the acid plating solutions dissolved appreciable iron from the steel cathodes at the extremely low current density areas of the panel. A deposit of nickel approximately 0.002 inch (.05 mm) thick was used to protect the steel panel over its entire area. During the preparation of deposits at higher current densities this precaution was found by experiment to be unnecessary since the steel was covered rapidly enough to prevent dissolution.

Since, in the evaluation of the deposits for the effect of the iron impurity the tests were predominantly visual and involved the personal element, reference deposits were prepared from standard solutions. These deposits then served as standards for the evaluation of the deposits from the contaminated solutions.

Within the concentration range of iron investigated there was no appreciable pitting of the deposits observed that could be attributed to the dissolved impurity. Hence, the use of a wetting agent was not necessary. The plating baths were filtered at intervals to remove any carbon or metallic nickel particles that were present. Filtration of the Watts *p*H 5.2 solution containing the iron impurity was not attempted since this would remove some of the iron in the form of a precipitate that was observed to form a short time after the ferrous salt was dissolved in the plating solution. In the investigation of this bath, fresh portions of the standard stock solution were used at each concentration of iron studied.

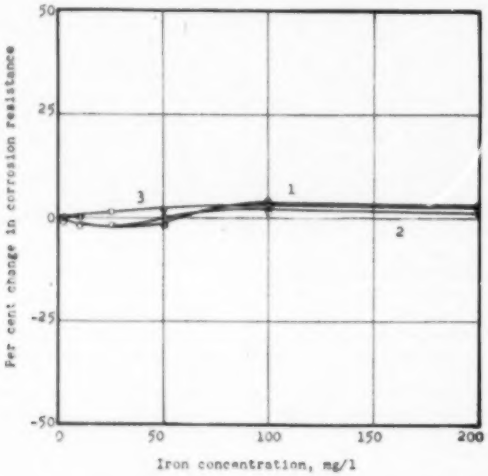

Fig. 1. Effect of iron concentration in the Watts type plating solution, pH 5.2, on the salt spray (fog) corrosion resistance of nickel deposits of varying thickness. (Curve 1 is for 0.0003 inch deposits; curve 2 for 0.0010 inch deposits; curve 3 for 0.0015 inch deposits)

B. Effects on Physical Properties

1. *Appearance*—Since two types of deposits, gray nickel and bright nickel, were under investigation, it was necessary to select different tests to determine the effects of iron on appearance. The gray nickel deposits were compared to the Eastman Gray Scale in which the lightest shade is arbitrarily given a value of unity with each succeedingly darker step increasing by unit value. The bright nickel deposits were classified in a range from dull to mirror bright. Table I summarizes the effect of iron on the appearance of the vertical sections of the nickel deposits from the four solutions at the standard average current density of 40 amp/ft² (4.3 amp/dm²).

In general, the effect of the iron was to whiten the gray nickel deposits to a slight extent. This was noticed with as little as 10 ppm of iron in solution. Increasing the iron concentration up to 200 ppm resulted in little change in appearance beyond that caused by the first few ppm. A mottled effect was also observed on the surface of deposits from the Watts *p*H 2.2 solution. This increased with increasing concentrations of dissolved iron. The deposits from the Watts *p*H 5.2 bath appeared to be smoother and finer grained than the corresponding deposits from the Watts *p*H 2.2 bath. There appeared to exist a slight tendency toward brightening in the deposits from the high *p*H solution as the concentration of dissolved iron reached 50–200 ppm.

The deposits from the two bright nickel solutions showed no appreciable change in appearance either in high, medium or low current density areas with from 0–200 ppm of iron. All of the deposits obtained from solutions in which the iron concentration was within this range were mirror bright.

2. *Adherence*—Contamination of the four nickel plating solutions under investigation with concentrations of iron up to 200 ppm caused no detectable change in the adherence of the nickel deposits to the steel base. The method of testing the adherence was to bend the horizontal section of the panel under pressure and examine the bend under a forty-power microscope for any change in this property. This test, admittedly qualitative, was deemed suitable for this investigation.

3. *Ductility*—Using the test for duc-

tility as described in previous papers[1,3], i. e., repeatedly creasing with the finger a predesignated portion of a stripped deposit until the first indications of rupture appear, a change in the ductility of the deposits from all the solutions except the nickel-cobalt alloy type bath was noticed when the concentration of dissolved iron reached 25–50 ppm. As the iron content increased, the ductility of the deposits decreased slightly. Since even the pure deposits from the standard nickel-cobalt alloy type solution were brittle compared to those from the other three types of solutions, only semiquantitative results could be obtained with these deposits using this method of measuring ductility. The results indicated that there was no appreciable change in the ductility of the deposits from nickel-cobalt solutions containing iron in concentrations up to 200 ppm.

4. *Salt Spray (Fog) Corrosion Resistance*—These tests were made according to A. S. T. M. designation: B 117-49T and the system of rating was that described in a previous paper[3]. The nickel deposits subjected to the salt spray were compared to A. S. T. M. panels No. 11 (before breakdown), No. 9 (at breakdown), and No. 7 (after breakdown), thus giving a standardized procedure for the evaluation of this physical property. The test panels were nickel plated steel, unbuffed.

The effect of iron on nickel deposits from the four solutions under investigation was determined. Three thicknesses of deposits—0.0003, 0.001 and 0.0015 inch (0.008, 0.025, 0.038 mm)—were made at each concentration of iron, i. e., 0, 2.5, 10, 25, 50, 100 and 200 ppm. The deposits, after cleaning with magnesium oxide, were subjected to the corrosion test. The results are reported as per cent change from the breakdown time of the corresponding reference deposit from the standard solution. The deposits were examined at one-half hour and one hour intervals. Since the 0.0003 inch (0.008 mm) deposits failed in considerably less time than the heavier deposits, i. e., within a few hours, the trends exhibited by these as shown by the accompanying curves do not present as reliable data as that revealed by the 0.001 and 0.0015 inch deposits (0.025, 0.038 mm). Any general trends discussed will be based primarily on the performance of the heavier deposits.

Within experimental error, the per cent change in the salt spray corrosion resistance due to a given iron concentration was the same for the 0.001 and 0.0015 inch (0.025, 0.038 mm) deposits. The deposits from the Watts type solutions showed no appreciable change in salt spray corrosion resistance when the iron in the solution was varied from 2.5 to 200 ppm (Figs. 1 and 2). The slight change that was observed was in the deposits from the low *p*H bath where a few per cent decrease in this property occurred in the range of 25–200 ppm of iron.

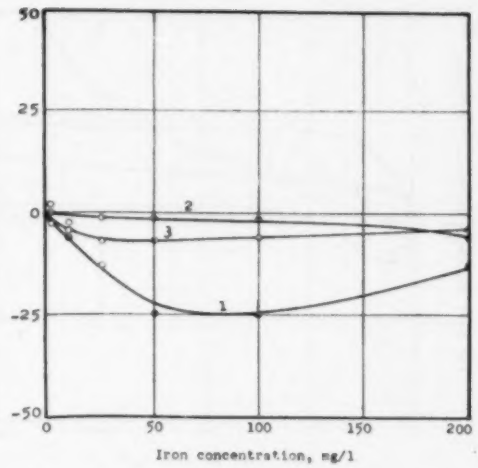

Fig. 2. Effect of iron concentration in the Watts type plating solution, pH 2.2, on salt spray (fog) corrosion resistance of nickel deposits of varying thickness. (Curve 1 is for 0.0003 inch deposits; curve 2 for 0.0010 inch deposits; curve 3 for 0.0015 inch deposits.)

The organic type deposits exhibited a decrease in corrosion-resistance when the iron content of the solution varied from 2.5 to 25 ppm (Fig. 3). As the concentration of iron was increased beyond this point up to 200 ppm, the corrosion resistance of the deposits exhibited little change from that of the pure deposits.

A definite increase in the corrosion resistance of nickel-cobalt type deposits was observed when the concentration of dissolved iron in the bath reached 25 ppm. With higher concentrations of iron present, up to 200 ppm, there was no further appreciable change detected (Fig. 4). However, the magnitude of this increased resistance to the salt spray was slight, being of the order of 10 to 20 per cent.

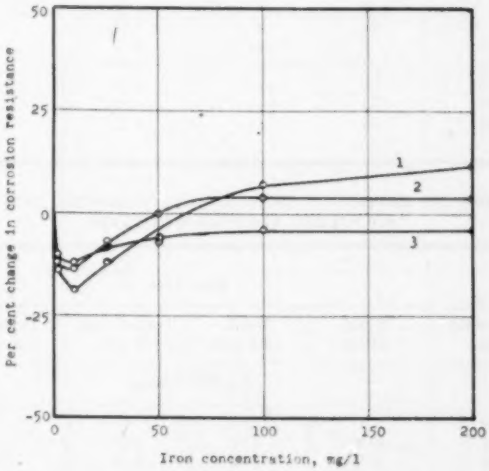

Fig. 3. Effect of iron concentration in an organic type nickel plating solution on the salt spray (fog) corrosion resistance of nickel deposits of varying thickness. (Curve 1 is for 0.0003 inch deposits; curve 2 for 0.0010 inch deposits; curve 3 for 0.0015 inch deposits.)

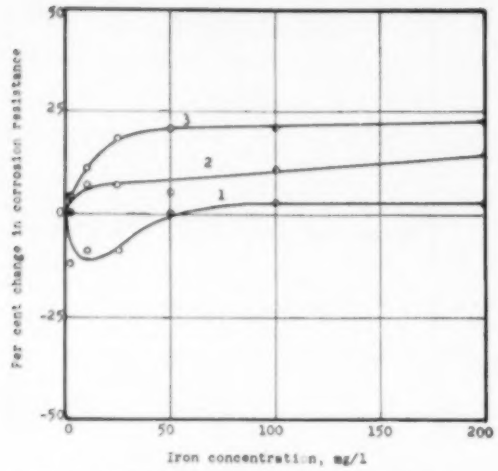

Fig. 4. Effect of iron concentration in an alloy type nickel plating solution on the salt spray (fog) corrosion resistance of nickel deposits of varying thickness. (Curve 1 is for 0.0003 inch deposits; curve 2 for 0.0010 inch deposits; curve 3 for 0.0015 inch deposits.)

TABLE II. EFFECT OF IRON ON THE THROWING POWER OF NICKEL PLATING SOLUTIONS

Iron Concentration mg/l	Bath Type			
	Watts *p*H 2.2	Watts *p*H 5.2	Nickel-Cobalt *p*H 3.75	Organic *p*H 3.2
	Per Cent Change			
0	0	0	0	0
2.5	+2	−2	+10	−3
10	0	−2	+ 5	−1
25	+5	−2	− 6	0
50	0	−7	+ 8	0
100	−3	−6	+ 4	0
200	+5	−4	+ 5	−2

TABLE III. EFFECT OF IRON ON THE THROWING POWER OF NICKEL PLATING SOLUTIONS

Iron Concentration mg/l	Bath Type			
	Watts *p*H 2.2	Watts *p*H 5.2	Nickel-Cobalt *p*H 3.75	Organic *p*H 3.2
	Per Cent Change			
0	—	—	—	—
2.5	+ 6	+15	+12	− 7
10	+ 7	+14	+18	+ 3
25	+26	+16	+23	+ 1
50	+12	+ 6	+ 2	−18
100	+22	+13	+10	−17
200	+18	+26	+10	+10

5. *Throwing Power*—Since no gassing was observed during the preparation of test panels in nickel solutions containing iron as an impurity in the range of 2.5–200 ppm, it was assumed that the cathode efficiency was unchanged. Therefore, any change in the deposit thickness as compared with the thickness of the pure deposit as a standard was considered to be due to the throwing power of the solution. Following the procedure described in a previous paper[4], the thickness of the deposits was determined by examination of the cross-section using a Bausch & Lomb research metallographic microscope. Table II summarizes the results.

In general, the deposits from the Watts *p*H 5.2 solution showed a slight decrease in the throwing power when varying concentrations of iron were present. The nickel-cobalt type of solution was observed to possess a slight increase in its throwing power under these conditions. However, as the concentration of iron was increased, no noticeable trend in the per cent changes was observed in either of the above solutions. The Watts *p*H 2.2 and organic type solutions exhibited no appreciable change in throwing power over the range of iron concentration investigated. It can be said that the effect of iron in all four plating solutions is insignificant.

6. *Hardness*—The tests for the hardness of the nickel deposits were made by A. E. S. Project No. 9 at the National Bureau of Standards, Washington, D. C. An Eberbach microhardness apparatus was used for these measurements applying a load of 18.6 grams. Both surface hardness and cross-section hardness readings were obtained and these were then converted to Vickers pyramid numbers (VPN). The results presented are given in terms of percentage change from the hardness of the pure deposits produced by the addition of the various concentrations of iron to the plating solutions. Table III summarizes the effect of iron concentration on the hardness of nickel deposits.

It is observed that in general the effect of iron in nickel plating solutions was to increase the hardness of the nickel deposits. A maximum degree of hardness was obtained when the iron concentration reached 10–25 ppm. At 50 ppm, the hardness values were at a minimum, while beyond this concentration, the deposits again showed a general increase in hardness. This hardening effect resulting from the presence of iron concentration in the nickel solutions was least evident on the deposits from the organic type solution. Certain concentrations of the impurity appeared to cause an actual decrease in the hardness of this type deposit. However, the general trends mentioned above were followed.

C. Removal of Iron

1. *Procedures*—Two methods for the

removal of iron from nickel solutions were studied, namely, low current density electrolysis and high *p*H treatment with nickel carbonate. Methods of analysis for the iron content of the solutions followed the procedure set forth by E. J. Serfass, et al[4].

The procedure for the preparation and plating of the deposits and the apparatus was that described in a previous publication[3]. In the low current density electrolytic method the current densities employed were 3, 5, 7 and 9 amp/ft² (0.3, 0.5, 0.8, 1 amp/dm²) at the operating temperature of the nickel baths. The agitation rate was 4 feet of solution per minute past the cathode. Flat pieces of nickel plated steel 2 inches wide by 3.5 inches long (5.1 x 8.9 cm) were used as cathodes. In order to determine whether the iron removed electrolytically was deposited with the nickel, strip deposits were made from the Watts *p*H 2.2, the organic type and the nickel-cobalt type baths containing known amounts of iron in solution. These deposits were analyzed for iron content. In all cases, the amount of iron found in the deposits was in close agreement with the drop in iron content of the three types of baths. Hence, in these three solutions the iron depleted from a bath was assumed to be co-deposited with the nickel on the cathode.

For the high *p*H removal of iron, nickel carbonate was added to the series of nickel solutions containing 200 ppm of iron. The amounts added were such as were necessary to give a series of *p*H values ranging from 2.0 to 5.8. Care was taken to insure that equilibrium conditions existed prior to the final *p*H measurement and the subsequent analyses for the iron by allowing the solutions to stand at room temperature for 72–96 hours before the samples to be analyzed were taken. Analyses were run before further change could take place.

2. *Evaluation of Results*—Since any iron present in the trivalent state is readily precipitated from the Watts *p*H 5.2 solution, this bath will be given separate consideration under the discussion of low current density electrolytic removal of iron.

On the basis of ampere hours of current per gallon of solution, the optimum current density of those investigated for the electrolytic removal of iron from the Watts *p*H 2.2, the organic type and the nickel-cobalt type solutions was found to be 5–7 amp/ft² (0.5–0.8 amp/dm²). Fig 5 illustrates the removal curves at these current densities under the specified conditions for the nickel solutions studied. At this current density range, the iron is removed from solution most economically on the basis of nickel deposited and current consumed. If time is a factor, a current density of 9 amp/ft² (1 amp/dm²) can be utilized to remove the iron more rapidly with an accompanying increase in the amount of nickel deposited. The ratio of nickel to iron in the deposit is increased as the current density is raised. Therefore, by increasing the cathode area rather than the current density, a more efficient removal of iron is obtained. However, as indicated by Fig. 5, this method for the removal of iron from nickel plating solutions is not highly effective.

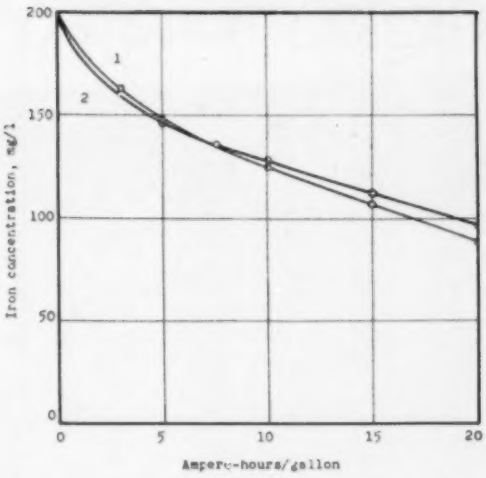

Fig. 5. Low current density electrolytic removal of iron from nickel plating baths (curve 1 is for 5 asf; curve 2 for 7 asf)

Fig. 6 represents the electrolytic depletion of iron from the three nickel plating solutions at 40 amp/ft² (4.3 amp/dm²). It can be stated that this removal is much more effective and time saving than the low current density method. The amount of nickel deposited at 40 amp/ft² (4.3 amp/dm²) is, however, extremely high when compared with that deposited at the low current densities. This factor may limit the application of the higher current density range as a method of iron removal. Fig. 6 further indicates that under operating conditions of most nickel plating baths the amount of iron in solution can be maintained at a relatively low concentration, providing that large

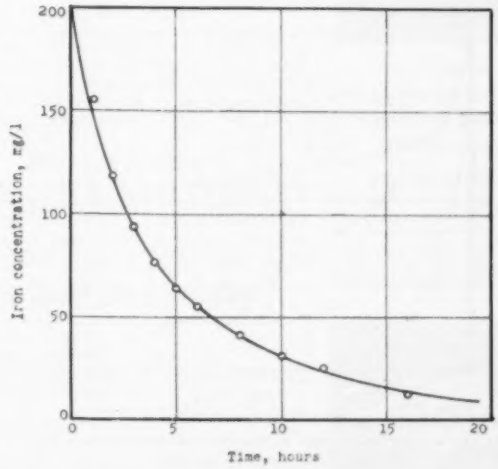

Fig. 6. Effect of high current density electrolysis (40 asf) on the concentration of iron in solution in nickel plating baths

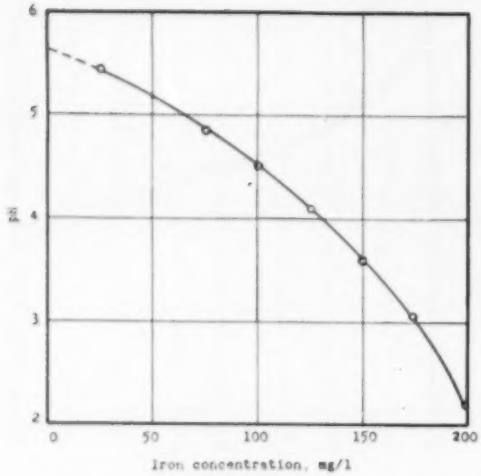

Fig. 7. Effect of pH on the concentration of iron in solution in nickel plating baths

amounts of the impurity are not continually being introduced into the bath. The data obtained from both the low and high current density electrolysis indicate that iron is removed electrolytically to a greater extent the lower the *p*H of the plating solution.

The results of the investigation on the removal of iron by raising the *p*H with nickel carbonate indicate that iron removed from a solution originally containing 200 ppm at a *p*H of 2.2 may vary with the type of solution. In the Watts type solution the iron concentration dropped to a value of 25 ppm at a *p*H of 5.7. The organic type solution had an iron content of 20 ppm at a *p*H of 5.65. Removal to below 5 ppm of iron from the nickel-cobalt type bath was effected at a *p*H of 5.35. Fig. 7 shows a composite curve for the removal of iron for the nickel solutions investigated. The extrapolation of this *p*H removal curve indicates that complete removal of the iron should be accomplished below a *p*H of 6.0. In all cases the iron could be removed by high *p*H treatment with little or no loss of nickel to a much lower concentration than was obtained by the low current density electrolytic method.

When the removal of iron from the Watts *p*H 5.2 bath is considered, special consideration must be given the part precipitation plays in the process. It was found that the concentration of iron in this solution tended to drop when the solution containing an original concentration of 200 ppm was maintained at 131° F (50° C) with four feet per minute agitation in the absence of electrolysis. With the drop in the iron content of the solution a precipitate appeared in the bath.

In the low current density electrolysis of the Watts *p*H 5.2 solution containing iron at a concentration of 200 ppm, the removal of the iron was observed to be the result of a combination of precipitation and electrolysis. Current densities of 3, 5, 7 and 9 amp/ft² (0.3, 0.5, 0.8, 1 amp/dm²) were used. For this bath it was found that 3–5 amp/ft² (0.3–0.5 amp/dm²) was the optimum current density for removal on the basis of ampere hours of current passed per gallon of solution. On the basis of time, 7–9 amp/ft² (0.8–1.0 amp/dm²) was the current density range of those investigated that proved most efficient. Any electrolytic procedure for the removal of iron from the plating solution at this elevated *p*H, 5.2, would encompass both electrolysis and precipitation. Since the rate of precipitation is dependent on a number of factors, absolute data are not presented on the removal of iron from this bath.

When it appeared that ferric iron would precipitate readily from the Watts bath *p*H 5.2, a check was made to see how completely and rapidly the iron would be removed if an oxidizing agent were used to convert it to the trivalent state. A liter of solution with an initial concentration of 200 ppm iron was treated with 10 ml of 3 per cent hydrogen peroxide, calculated as a 15 per cent molar excess of the reagent. Analysis showed the iron content of the solution to have dropped to a few ppm in ten minutes, and to less than two ppm in one hour. Fig. 8 shows the comparative rates of removal of iron by different methods from the high *p*H Watts solution.

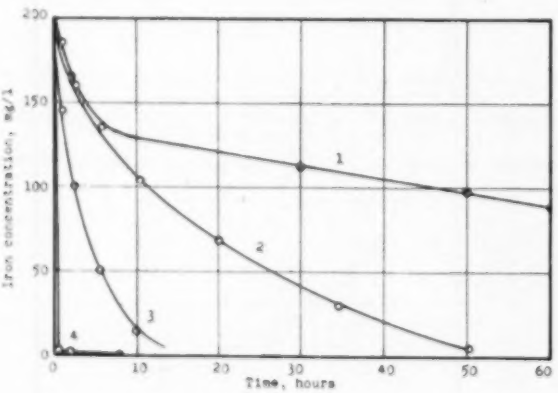

Fig. 8. Comparative rates of iron removal, Watts bath, pH 5.2
1. Operating conditions with no current
2. Low current density removal, 5–7 asf
3. High current density removal, 40 asf
4. Hydrogen peroxide treatment

Summary

The results of this investigation of the effects of iron on nickel deposits and its removal from nickel plating solutions can be summarized as follows:

A whitening effect on the gray nickel deposits was observed with an iron concentration of 10–200 ppm present in solution. The deposits from the bright nickel solution exhibited no change in appearance within a range of 0–200 ppm of iron investigated.

The nickel deposits from solutions containing 0–200 ppm of iron evidenced no detectable change in the adherence of the deposits to the base metal.

A slight initial decrease in the ductility of the deposits from the Watts type solutions and the organic solution was found when the iron concentration reached 25-50 ppm. Increasing the concentration to 200 ppm produced a further slight decrease in the ductility of the deposits. The nickel-cobalt deposits exhibited no detectable change in this property over the range of the impurity studied.

In general, it may be stated that the deposits from each of the different types of solutions, with the exception of those from the alloy type bath, showed little or no change in their salt spray corrosion resistance properties with from 0–200 ppm of iron present in solution. The nickel alloy deposits showed a 10–20 per cent increase in corrosion resistance with 25-200 ppm of iron.

The effect of iron on the throwing power of the four types of solutions with up to 200 ppm present was insignificant.

Nickel deposited from solutions containing 2.5–200 ppm of iron generally exhibited an increase in hardness.

In the case of the Watts *p*H 5.2 bath, the iron formed a noticeable precipitate in the solution. This, it is felt, caused some roughness, particularly on the horizontal section of the deposits from this solution.

Iron can be removed from nickel plating solutions by high *p*H treatment with nickel carbonate to a value of 25 ppm or less with no appreciable loss in nickel. By using an oxidizing agent, a more complete removal of the iron is attained at a lower *p*H level in a shorter time. Curve 4 in Fig. 8 illustrates the advantage of the hydrogen peroxide treatment as a method of iron removal at *p*H values above 5.0 The most economical and complete method for removing iron appears to be oxidation and high *p*H precipitation.

Iron may also be removed from solution by high and low current density electrolysis. However, this general method of iron removal is ineffective if it is desired to remove iron to a concentration below 50 ppm without excessive deposition of nickel. Even at higher concentrations of iron, the electrolytic removal proceeds relatively slowly.

ACKNOWLEDGMENTS

We wish to acknowledge with thanks certain data made available to us by Mr. B. C. Case through a fellowship sponsored by the Hanson-Van Winkle-Munning Company in this institution.

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The 40th Annual A.E.S. CONVENTION

The 40th Annual Convention is being sponsored by the Philadelphia Branch with its neighbors, the Allentown-Reading and the Lancaster Branches as co-sponsors. The membership of these three branches represents platers from all of the eastern half of Pennsylvania and from western New Jersey.

The Allentown-Reading Branch

The Allentown-Reading branch, centered some 40 miles northwest of Phila-

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delphia, represents an area whose major industry is metals and metal processing. Basic steel products represent a major portion of this business but fabrication of such equipment as hardware, appliances and automobiles makes the plating industry of strong importance.

The Allentown-Reading group held its first organizational meeting in July of 1948. An enthusiastic response at this meeting confirmed the desirability of establishing a permanent unit. The Branch charter was formally presented on April 30, 1949 by the Supreme President, Sam Johnston. There are currently 44 members of the Branch.

The officers of the Branch are:

President—JAMES RIEGEL
First Vice-President—JOSEPH MCKEONE
Second Vice-President—L. GEORGE NISSEN
Secretary-Treasurer—LEE C. WOTRING
Librarian—HOWARD SCHEARER
40th Convention Representative—NORMAN H. MILLER

Meetings are currently being held on the third Wednesday of the month in Allentown.

The Lancaster Branch

The Lancaster Branch represents an area centering 60 miles west of Philadelphia and includes the cities of Lancaster, York, Harrisburg and Hanover. It is interesting to note that 75 per cent of the wire cloth made in this country is produced in this section. Much of this material is plated. Other metal finishing industries in this area produce furniture, toys, kitchen utensils, watches, electronic equipment, hardware, and office equipment.

The first meeting of the group was held in December of 1939; full organization was effected in January of 1940 and the first technical meeting was held in February. The permanent charter was presented to the Lancaster Branch April 12, 1940 by George Gebling of the Philadelphia Branch.

Officers of the Lancaster Branch are:

President—WILLIAM H. FOURNEY
Vice-President—JOHN M. REYNOLDS
Secretary-Treasurer—HARRY A. SAYLOR
Librarian—ARTHUR J. ARSENAULT
40th Convention Representative—HARRY L. HOVIS

The Branch meets on the second Friday of the month at the Thaddeus Stevens Industrial School in Lancaster. Current membership is 69.

The Convention Outing

The outing for the 1953 Convention looks so different and exciting that the Philadelphia Branch has decided to announce this phase of the program at this relatively early date.

The outing will be a chartered boat ride on the Delaware River. The Wilson Line's beautiful new "Delaware Belle" has been signed up for the exclusive use of the A. E. S. for a full afternoon of food, party, and boat ride all at once!

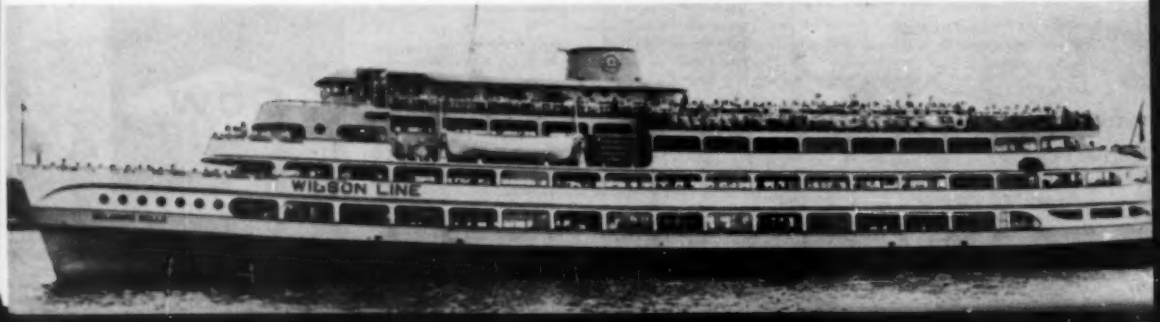
This looks so good that it is difficult to decide what to talk about first. The time will be Wednesday afternoon, June 17; the trip will be down the Delaware and return. Lunch will be included, there will be an orchestra for dancing, special games for those who are interested; it will be wonderful for just loafing, and will be a sightseeing treat.

The pier is just a few blocks from the headquarters hotel, the Benjamin Franklin. (No long, hot bus rides.) The boat ride will take the group past Chester, Marcus Hook, and Wilmington. Among the historical sights that will be seen are; the largest Navy Yard in the world, the refineries of Marcus Hook, the new Wilmington Memorial Bridge, and the many other interesting points along this river which carries ocean trade up to Philadelphia.

And the group can laugh at the weather! If it's hot, a river ride will be cooling; should it rain, there are plenty of covered decks. They can't lose either way.

It can be seen from the advance information that this 40th Annual Convention is going to be the standard of perfection for years to come and that the boat trip is going to be a high-point of the whole program.

The Wilson Line Delaware Belle has been chartered for the outing of the 1953 A. E. S. Convention



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Book Review

DR. HAROLD J. READ
Professor of Metallurgy, Pennsylvania State College

THE MEASUREMENT AND CONTROL OF TEMPERATURES IN INDUSTRY by P. Hoyds, 1952, vii + 200 pages. The Chemical Publishing Company, Inc., 212 Fifth Avenue, New York 10, N. Y. Price, $5.00.

In view of the importance of measurement and control of temperatures in manufacturing processes, several books on this subject have appeared in the last few years. The volume under review here is not one of the best of these, particularly from the standpoint of the metal finisher. Although the book contains no glaring inaccuracies and is reasonably up to date, the main difficulty with respect to its use by a metal finisher is that a great deal of the book is concerned with those aspects of temperature measurement and control which are not applicable to his industry. A large fraction of the book is devoted to discussions of total radiation, optical, pirioelectric and other pyrometers, instruments for the measurement of high temperatures not normally encountered in electroplating or other finishing activities. In addition, two rather long chapters are concerned with measuring the mean temperature of metal walls and with determining rapidly fluctuating temperatures. When these sections and some others of little topical interest are deducted from the book as a whole, relatively little remains to interest the electroplater.

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People and Industry. H. Silman. J. Electrodepos. Tech. Soc., **28**, 1–14 (1952).

A brilliantly written Presidential Address which obviously took much thoughtful analysis and careful preparation. Since this address is published in its entirety in "Metal Finishing", 50, 5, 51–56 (1952), it will not be here abstracted further; there are, however, a few comments which this abstractor would like to make.

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The process is devoted entirely to the application of porcelain enamel to standard shapes, which are cold-rolled from 61S aluminum coiled sheet. The processing of the formed piece can be broken down into (1) treating the metal, (2) milling the enamel, (3) spraying, (4) firing, (5) testing and inspection, and (6) re-rolling. Strict control is exercised over each step in the process to insure quality and quantity production.

People and Industry. H. Silman. J. Electrodepos. Tech. Soc., **28**, 1–14 (1952).

A brilliantly written Presidential Address which obviously took much thoughtful analysis and careful preparation. Since this address is published in its entirety in "Metal Finishing", 50, 5, 51–56 (1952), it will not be here abstracted further; there are, however, a few comments which this abstractor would like to make.

Although problems involving people, in the U. S., are not exactly parallel to those in Britain, there is much similarity. Here there is not active open opposition to the installation of modern mechanical handling

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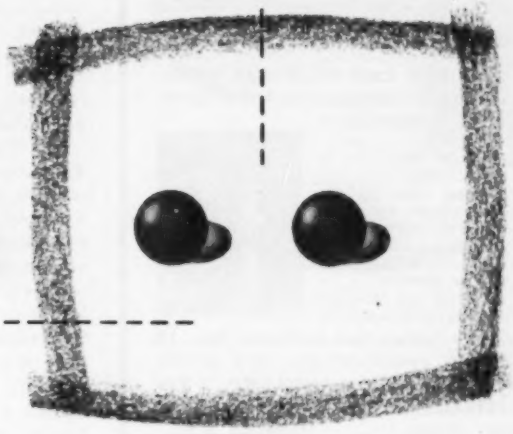

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Article Abstracts

equipment, but there is propagation of the same short-sighted fallacious theory that such equipment produces unemployment by throwing men out of work. This is met here by "feather-bedding"—i. e., requiring that a man be provided to do a job where no job actually exists; and by limiting piece-workers, or incentive workers, to a certain amount of production per day. At least the opposition our British friends must face is morally honest.

It may well be that whoever first is able to cut loose this dragging anchor to production will gain world leadership.

Mr. Silman states that "In this respect (productivity), the United States has usurped the position occupied by this country some decades ago". In an American dictionary, "usurp" means to "take by force and without right". There are subtle differences in the meanings and connotation of words in the two countries, and this may be the case here; but if not, Mr. Silman's choice of a verb was unfortunate. We believe that we have the right to leadership in productivity, if we can take it.—*L. B. Sperry.*

Process for Coating Metallic Objects with Other Metals. M. Alfierieff. British Patent 676,198 (Dec. 1, 1947) (Spain, July 31, 1946).

Complete specification published July 23, 1952. Light Metals Bull. 14, p. 688 (Aug. 15, 1952). A continuous process of coating a metal (steel strip) with aluminum, zinc, lead, cadmium or tin, or with an aluminum alloy, consists in heating the metal to a temperature from 35° to 180° F lower than the annealing temperature of the metal in a reducing atmosphere, then expelling gases by treating the metal at the annealing temperature while exposing the whole surface of the metal to a continuous stream of a practically inert atmosphere, and then, while the metal is wholly protected by this inert atmosphere, passing it into a bath of molten metal. An apparatus for carrying out the continuous coating of strip by the above process is described, the coating of steel strip with aluminum being dealt with by way of an example.

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Patent Abstracts

GEORGE B. HOGABOOM
Consultant, New Britain, Conn.

Copies of patents may be obtained by writing to Commissioner of Patents. Washington 25, D.C. Price 25 cents each.

No. 2,609,339, September 2, 1952—Bright Copper Plating from Cyanide Baths—Frank Passal, assignor to United Chromium, Incorporated.

Advantages of the bath and process according to the present invention are:

1. Wide limits of the free cyanide without detriment to smooth and bright deposits, and the cathode current density efficiency;
2. High current efficiency, with bright and smooth deposits obtainable at 90–100 per cent cathode current efficiency;
3. Pitting of electrodeposit is avoided;
4. Free rinsing properties of the electrodeposits, making unnecessary a special cleaning cycle after copper plating and prior to bright nickel plating;
5. Low concentration and stability of the brightener used, making the bath economical to operate;
6. Wide latitude in the operating temperature range; and
7. Softness and easy flow of the copper electrodeposit on buffing.

BATH COMPOSITION

	g/l	*Range*
CuCn	63.5	30–75
Total KCN	100.0	50–125
KOH	15.0	7.5–30
Rhodanine (brightening agent)	0.05	0.005–1.0
*p*H	.....	12.5–13.5
Cathode current density	8–25	5–35 amp/sq ft
Temperature	170° F	140°–180° F
Cathode bar agitation	15 ft/min	5–20

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Brighter plating—Anodic conditioning with Oakite Composition No. 95 removes all films that might impair the brightness of the electroplate . . . no interfering residues . . . no under-surface shadows . . .

No anodic blackening—Castings do not lose their buffed-on brightness.

Fewer rejects—Oakite Composition No. 95 eliminates the major causes of peeling and blistering . . . consistent success in test-baking for 60 minutes at 300° F.

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TO CAP STUD SIZE	3/32-5/32	5/32-3/16	3/16-1/4	1/4-5/16	5/16-3/8	3/8-7/16	9/16-1/2

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ANALYTICAL VALUES

	g/l	Range
Cu	45	20–55
Free KCN	11.2	5–13
KOH	15	7.5–30

CLAIM 1. An aqueous cyanide type bath for electroplating copper having as its essential constituents: Cu 20–55 grams per liter, free KCN 5-13 g/l KOH 7.5–30 g/l and 0.005 to 1 g/l Rhodanine as a brightening agent

4 claims, 1 example.

References cited: U. S. Patent 2,347,448; Denmark 49,603.

No. 2,610,143 and 2,610,144, September 9, 1952—Method of Electropolishing—S. E. Eaton, assignor Oneida Limited, Oneida, N. Y.

2,610,143

CLAIM 6. Method for the anodic polishing of silver, copper, cadmium, alloys consisting of these metals, brass, bronze, zinc and nickel silver, in an electrolytic cell containing a cyanide bath, which comprises the steps of applying a continuously unidirectional, substantially constant initial electric current and potential difference between such metal, as the anode surface, and the cathode cell and of imposing an abruptly changed fluctuation of such potential difference between such metal, as the anode surface and the cathode of the cell, the limits of which fluctuation are below that potential which will form permanent discoloration within the portion of the period of the fluctuations during which it is maintained and above the potential which will form etching within the portion of the period of the fluctuations, during which it is maintained, the complete time cycle of each variation being approximately 1 to 30 seconds until at least a portion of the exposed anodic surface of such metal acquires a polish thereon.

6 claims, 27 figures.

2,610,144

CLAIM 1. Method of anodic polishing of silver, copper, cadmium, alloys consisting of these metals, brass, zinc and nickel-silver in an electrolytic cell containing a cyanide bath in which the rate of agitation of the

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Patent Abstracts

anode with respect to the electrolyte affects the potential difference-current density curve and the location of the equilibrium etching, polishing and permanent coloration regions with respect to said curve, said method comprising the steps of setting up an initial agitation of such metal with respect to the electrolyte, applying a potential difference between the anode and the cathode, said potential difference being in equilibrium polishing region, cyclically changing said rate of agitation to shift the resulting potential difference-current density values to a point outside of said polishing region for a period of time short enough to avoid the formation of a permanent etch or a permanent coloration, and repeating said cycle until at least a portion of the anode acquires a polish.

12 claims, 8 figures.

References cited: U. S. Patents 1,566,265; 2,416,294; 2,473,923. Transactions—Electrochemical Society, Vol. 81 (1942), pp. 199–211. The "Iron Age", Vol. 157, June 6, 1946, p. 65.

No. 2,612,469, September 30, 1952—Rapid Fine-Grained Copper Electrodeposition—Frederick F. Reisinger, assignor to The Wire Coating and Manufacturing Company, Cleveland, Ohio.

Copper plating by means of copper cyanide is quite an old industry, and from time to time detailed improvements in bath composition have been suggested, such as Rochelle salt copper bath, pyrophosphate copper, etc., but a fundamental handicap has remained that plating cannot be operated at high current densities, a desirable for volume production. . . . A bath for electrodeposition which can permit high operating rates, with current densities of 30 or more amp/ft², and with production of bright fine-grained deposits has accordingly been much desired in the industry.

CLAIM 1. In a process of preparing a bath for electrodepositing copper, dissolving anthranilic acid in hydrochloric acid solution, reacting upon the same with a diazotizing agent, then precipitating by H_2S,

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1— 1500 A. HVW 6/12 V.	1— 800 A. G. E. 28 V.
1— 800 A. HVW 6/12 V.	1—1500 A. Cent. 28 V.
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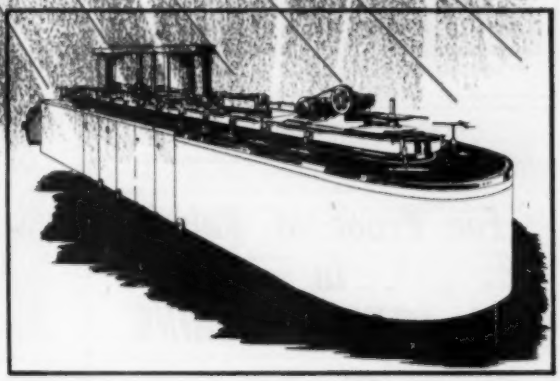

★ produces a brilliant, soft, copper plate requiring no buffing to produce high color; it comes from the tank with adequate brilliance.

★ if smoothness is a factor and if the base metal itself is not buffed or polished, simple buffing of the Lea Copper-Glo coating will produce an excellent smooth finish without diminishing its inherent brilliance.

WHETHER you are interested in brilliance only or in brilliance plus smoothness in the copper plating phase, you can save in production time (and in plating material) by using Lea Copper-Glo. You cut production costs by eliminating entirely or reducing substantially prior grinding operations on either cast, forged, or spun pieces.

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Investigate LEA CUPRALL for operations where ONLY BUFFABILITY rather than a combination of buffability and brightness is required. It's an all-purpose cyanide copper addition agent.

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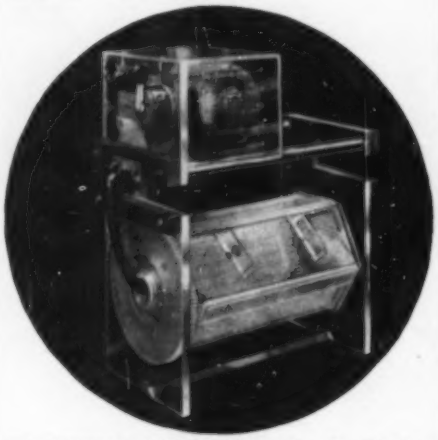

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Patent Abstracts

dewatering the precipitate, dissolving the precipitate and boiling in triethanolamine and water, cooling, filtering, mixing with a solution containing copper cyanide, sodium cyanide and sodium hydroxide, boiling, cooling, filtering, adding a wetting agent, making a stock volume with water, and adding a minor proportion of such stock solution to an electrodeposition bath containing copper cyanide, sodium cyanide and sodium hydroxide.

Copper Solution

Copper cyanide	392 gms
Sodium cyanide	438 gms
Sodium hydroxide	99 gms
Long chain alcohol addition agent	210 ml
Water to make	24 gal
Stock solution	50–75 ml

7 claims.

References cited: U. S. Patents 2,195,409; 2,271,209; 2,287,654; 2,424,887; 2,471,918; 2,495,668. British Patent 199,706.

No. 2,613,178, October 7, 1952—Method of Electroforming Seamless Tubes—A. W. Grant, assignor to United States Rubber Company.

CLAIM 2. The method of making a seamless tubular metal object having a smooth accurate non-oxidizing inner surface, which comprises providing a steel form having a smooth accurately formed outer surface, electrodepositing a thin barrier in the form of a flash film of copper over the form, electrodepositing a film of lead over this film of copper, electrodepositing a second flash film of copper of similar thickness to the first over the lead, electrodepositing a protecting film of non-oxidizing metal selected from the group consisting of chromium, nickel and silver over the second film of copper, electrodepositing a seamless iron jacket over said protecting film, then melting the lead film and drawing the iron jacket lined with the protecting film

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2. "Leaves non-ferrous metals in a passivated state resistant to further oxidation."

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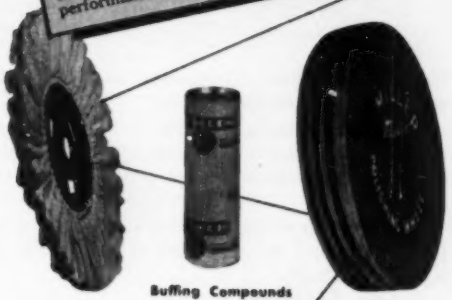
The name Miller on a product is the positive symbol of sound investment; the tops in quality; the last word in performance, results and economy.



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55	22"	34"	36.50
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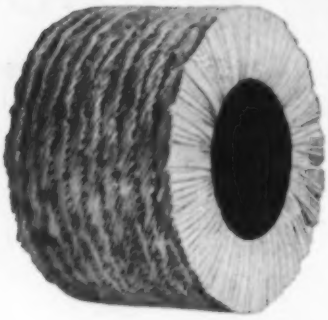
New "P-30" *Churchill* FINGER-BUFF



Produced in all types of cloth and in all sizes from 6" to 18" dia.

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Free sample on request.

Pleated construction and angle of pleats of each buff finger enables new "P-30" to hold compound better — cut faster — prevent gouging or streaking of work

Applying the same principle of "Self-air-cooled" finger-type construction originated by Geo. R. Churchill Co., the new "P-30" Churchill Finger Buff* is constructed by folding the cloth into pleats.

It is this pleated construction that traps and holds the cutting compounds better for all kinds of polishing and buffing jobs. Furthermore, each pleated buff finger is set at the proper angle on the wheel to prevent gouging or streaking of the work.

In addition, the individual buff finger principle is retained to give this new Churchill "P-30" Buffing Wheel the same cooler-running properties that help make Churchill Finger Buffs* wear longer and cost less.

Churchill "P-30's" are priced the same as the regular line of Churchill Finger Buffs*. They are produced in all types of bias cut cloth and in all sizes from 6" to 18" diameters.

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Patent Abstracts

off the form, and removing the second flash film of copper.

3 claims, 4 figures.

References cited: U. S. Patents 602,212; 850,912; 1,412,174; 1,566,984. British patents 12,264; 230,456; 239,977.

No. 2,615,839, October 28, 1952—Recovery of Precious Metals from Photographic Baths—H. O. Willier, Bethesda, Md.

CLAIM 1. The method of removing silver from a photographic fixing solution, comprising steps of: establishing a substantially quiescent body of fixing solution, establishing an anode zone within but adjacent one side of said body and a cathode zone consisting essentially of an electrodepositing zone of substantial depth within but adjacent the opposite side of said body, passing an electric current from said anode zone to said cathode zone, causing said current to leave said solution in said cathode zone through a multitude of ion collecting cathode surfaces therein facing in all directions, said surfaces being so arranged as to substantially but not completely encompass a multitude of discrete portions of said solution in said electrodepositing zone whereby silver ions in said discrete portions may move in substantially any direction toward one of said surfaces and thus effect rapid removal of said silver ions from said portions.

CLAIM 2. The method of claim 1 wherein said electric current is passed from said anode zone to said cathode zone at a voltage of from one to one and two-tenths volts.

CLAIM 3. The method of claim 1 wherein said surfaces are defined by a plurality of closely adjacent layers of wire mesh.

3 claims, 7 figures.

References cited: U. S. Patents 1,776,787; 1,866,701; 1,905,467; 1,954,316; 2,158,410; 2,275,194. British patents 100,739; 420,402; 452,466. Australian patent 27,461.

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Electrochemical Society Honors Dr. William Blum

J. C. Warner, President of the Electrochemical Society, presents a certificate of Honorary membership to William Blum. Mr. George Hogaboom completes the trio

Dr. Blum was made an Honorary Member of the Electrochemical Society at the 102nd meeting of the Society in Montreal. At a general Society luncheon on October 27 Mr. George B. Hogaboom lauded Dr. Blum's accomplishments and commented upon his inspiration to many from a personal standpoint because of his close association with Dr. Blum over many years. Both attended the first Electrochemical Society meeting in Atlantic City in 1912 and George reported that subsequently Dr. Blum served as Secretary of the Electrodeposition Section and President of the Society in 1926, and over the years was author of 12 papers and co-author of a dozen more.

Mr. Hogaboom spelled out the many honors conferred on Dr. Blum, including Honorary Membership in the A. E. S. and the A. E. S. Research Committee.

Addressing President Warner, Dr. Blum expressed his gratitude for the honor and explained it as the result of loyal cooperation of many associates. He then justified the existence of the Electrochemical Society and other specialized organizations on a two-fold basis:

(1) The society makes it possible to increase the specialized knowledge of the members, and

(2) It gives the member an opportunity to learn as much science outside his immediate field as possible.

Abstracts of the twenty-four papers presented before the Electrodeposition Division, not including six presented in joint session with the Industrial Electrolytic Division, will be reported herewith and in the January issue of PLATING.—ELECTRODEPOSITION OF COPPER FROM THE MONOETHANOLAMINE BATH—T. L. Rama Char and N. B. Shivaraman—Copper deposits from a complex copper-monoethanolamine solution are smooth, fine-grained, bright and adherent. The inclusion of Rochelle salt considerably improves its performance. The optimum conditions are: copper oxalate 60 g/l, monoethanolamine 60 ml/l, Rochelle salt 60 g/l, 2.4 to 4.8 amp/dm² (22.3 to 44.6 amp/ft²), 2.9 to 4.3 volts, *p*H 9.5, and 24° C. The addition of nitrates has some beneficial effect.

STUDIES OF THE MECHANISM OF BRIGHT PLATING IN THE ACID COPPER BATH—Bacon Ke and Dan Trivich—In the acid copper bath, polarography shows that thiourea suppresses the maximum and shifts $E_{1/2}$ for copper to more negative potentials, while dextrin lowers the diffusion current, the effects of the two being additive. With brighteners, the deposits are polycrystalline and bright all over. Thiourea with S^{35} shows no localized adsorption on Cu single crystals.

THE ELECTRODEPOSITION OF COPPER AND NICKEL—John Yeager, Ernest Yeager and Frank Hovorka—Polarization and structural measurements were made for copper and nickel as typical metals with low and high polarization. A stream of electrolyte was directed past the electrode to minimize concentration polarization. The build-up and decay of the polarization following the initiation and interruption of the current were also determined.

THE EFFECT OF ULTRASONIC WAVES ON THE ELECTRODEPOSITION OF COPPER—W. R. Wolfe, Hyman Chessin, Ernest Yeager and Frank Hovorka—The effects of ultrasonic waves on the electrodeposition of copper were determined at frequencies of 200 and 1000 kc/sec with acid plating baths of various concentrations. Polarization measurements were made by the direct method, while structural information concerning the deposits were obtained through X-ray and photomicrographic studies.

A NEW APPROACH TO THE INVESTIGATION OF ADDITION AGENTS—B. I. Parsons and C. A. Winkler—The system under investigation is a copper-copper sulfate-sulfuric acid bath with gelatin as addition agent. Changes in cathode polarization in a Haring Cell were determined with a cathode ray oscillograph. If no addition agent is present the polarization rises almost instantaneously to 100 mv after the current is switched on, then slowly increases to 110 mv. When gelatin is present in the electrolyte the polarization rises to about 250 mv within five seconds, falls to 200 mv during the next ten seconds of deposition, then slowly increases to the steady state polarization characteristic of the gelatin concentration.

Electroplaters Honor William Phillips

On Friday, October 3, over 225 members and guests of the Detroit Branch paid tribute to William M. (Bill) Phillips, Research Consultant, General Motors Laboratories, for his 40 years of service to the electroplting industry. Mr. Phillips was made a member of the "Order of The Pot", a group consisting of past National Presidents of the Society, and also was presented with a 21-inch television set donated by members of the branch.

Mr. Frank Clifton, who has been a co-worker with Mr. Phillips for many years, pointed out some of Phillips' background and accomplishments during his many years in the industry. He reported that "Bill" Phillips attained his B.S. degree from the University of Pennsylvania. After graduating he was employed for 8 years at the Inland Manufacturing Company where he eventually became General Manager. In 1921, Phillips joined the General Motors Corporation and has remained there ever since. He served as advisor on electroplating, painting, and enameling and also was Head of the Electrochemistry Department at General Motors Research Laboratories for many years. At present in addition to being Research Consultant for the General Motors Corporation, he is connected with the National Production Authority serving on committees studying controls on metals used in electroplating. Almost half his time is spent with the National Production Authority in Washington.

Mr. Clifton said further that Mr. Phillips is both a past National President and an Honorary Member of the American Electroplaters' Society. He is also a member of many other technical organizations including the American Society for Testing Materials, Society of Automotive Engineers, Engineering Society of Detroit, Society of the Plastics Industry, American Ordnance Society, Society of Plastics Engineers, and American Society for the Advancement of Science. He has obtained patents on electroplating and rubber application processes and also has written many technical articles. Clifton described Phillips as "a true dean of electroplating who has contributed more than his share to the industry".

Mr. Walter Pinner of the Houdaille-Hershey Corporation then brought to light a number of Phillips' other activities including hobbies and interesting anecdotes about his public life in the plating industry.

"Bill" Phillips himself addressed the branch discussing *Metal Shortages Viewed from Washington*. He predicted that controls on metal, particularly nickel, will be eased considerably in the second quarter of 1953. He said that improved manufacturing methods in the jet engine manufacturing program should result in a considerable saving of high nickel alloys. Also, nickel production itself is to be substantially stepped up in 1953. About 20 million pounds per year more are to be produced than at present. Seventy per cent of the total world nickel supply is now being used by the United States.

The Atomic Energy program requires about 5 to 7 per cent of the United States consumption but Mr. Phillips expressed the opinion that once Atomic Energy equipment is constructed, no vast quantities of nickel would be required. This also would help release nickel for electroplating uses.

The National Production Authority considers electroplating important to the economy of the United States and acknowledges that brightly plated parts are essential to sell automobiles to the American public. The automotive industry is said to represent one-eighth of this country's economy.

Bill Phillips said that eventually all controls on metals would be revoked as the military program becomes stabilized. The NPA is making good progress toward getting enough nickel to plate all civilian goods without interfering with a reasonable military program.

Bill Phillips (left) is Presented with "Pot" by Walter Pinner. From left: H. E. Head, President, Detroit Branch, A. E. S.; Bill Phillips, Fred Wagner, Educational Chairman, Detroit Branch; F. L. Clifton

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2—5000/2500 AMPERE, 9/18 VOLT, **ELECTRIC PRODUCTS,** 25° C. Synchr.
1—5000/2500 AMPERE, 9/18 VOLT, **CHANDEYSSON,** 25° C. Synchr. Motor.
1—5000/2500 AMPERE, 6/12 VOLT, **EAGER.**
1—3000/1500 AMPERE, 6/12 VOLT, **HANSON-VAN WINKLE-MUNNING CO.**
1—2500/1250 AMPERE, 6/12 VOLT, **HANSON-VAN WINKLE-MUNNING CO.**
1—2000/1000 AMPERE, 6/12 VOLT, **MUNNING** "OPTIMUS."
1—1500/750 AMPERE, 6/12 VOLT, **HANSON-VAN WINKLE-MUNNING CO.**
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A.E.S News

Past President Feeley

Recently Mr. George Hogaboom and your Executive Secretary had the pleasure of discussing A. E. S. affairs with Past President and Honorary member John Feeley in Montreal. Many of the membership will be interested to know that Mr. Feeley braves the cold breezes to walk from his shop (he is President of the plating firm, John Feeley and Sons) to his home at 3549 Lorne Street, Montreal.

Editorial Board Plans Convention Program

The Editorial Board met at the Curtis House, Woodbury, Conn., on October 17, primarily to plan for the Educational Sessions to be held in conjunction with the Philadelphia Convention. Philadelphia was represented by Board member Fred Fulforth and General Chairman, Sam Heiman. Milton Nadel and George Schore of New York (1954 Host Branch) also attended the meeting.

Some fifteen papers were discussed and it was decided that all authors wishing to present papers should supply abstracts by January 15, 1953. Members who may be considering preparing papers are urged to keep this date in mind and submit abstracts to the Executive Secretary or any Editorial Board member promptly.

The meeting place was excellent and the Editorial Board is indebted to Mr. Candee and to the Lea Manufacturing Company for their hospitality.

Headquarters has received a letter from an electroplater and part owner of a shop in Tel Aviv, Israel, who wishes to practice modern methods in the U. S. A. The currency regulations of his country prevent his doing this in a normal way, and he therefore proposes to one of our readers the following "exchange scholarship".

"The person interested—who must be experienced in electroplating or polishing shall go to Israel and manage the shop, for which he shall receive the normal salary. In exchange he must enable the writer to work in a modern plant in the U. S. A. The arrangement can be for three to six months".

Anyone interested in the above proposal may secure further information by writing to headquarters, 445 Broad Street, Newark 2, N. J.

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Branch News

COMING EVENTS

DETROIT BRANCH

ANNUAL EDUCATIONAL SESSION AND BANQUET
Hotel Statler—Detroit

Friday, December 5 at 8:00 P. M., and Saturday, December 6, at 7:00 P. M. respectively

MR. FRANKLIN J. MACSTOKER, A. E. S. Supreme President, honorary chairman, presiding

MR. B. C. CASE, Manager of Research and Development, Hanson-Van Winkle-Munning Company, "Engineering Materials for Plating Room Equipment"

DR. D. G. FOULKE, A. E. S. Executive Secretary, "The National Society"

MR. R. G. CHOLLAR, Director of Research, National Cash Register Company, "Cooperating with the Inevitable"

Movie by the International Nickel Company, "The Nature of Corrosion—Anode and Cathode Processes"

The film is initial part of the three-part color film, "Corrosion in Action"

BALTIMORE-WASHINGTON BRANCH

On October 14, the Baltimore-Washington Branch met at the Allied Research Corporation, Baltimore, Md., for the first meeting of the current season.

The speaker of the evening was MR. CHARLES OSTRANDER of Allied Research. His subject was "Chromate Conversion Coatings for Decorative and Protective Metal Finishing". This talk was followed by a tour of the Allied Research plant and by the serving of refreshments.

Our Branch was requested by the Chicago Branch to support the amendment whereby dues would be increased to cover the payment of $1.00 per member to the A. E. S. Research Fund. Inasmuch as it has long been the practice of the Baltimore-Washington Branch to contribute to the Research Fund, delegates were instructed to support the amendment when it is brought to a vote.

MR. FIELDING OGBURN's proposal to alter the manner of accrediting of delegates was discussed. The Branch is now awaiting word from the Executive Board on this matter.

The Statler Hotel was approved for the A. E. S. Convention to be held in Washington, June 17, 1956. DR. W. BLUM and MR. T. SLATTERY have accepted the positions of Honorary Co-Chairmen of the 1956 convention; MR. A. PIERDON, who has acted as Temporary Chairman, was named Permanent Chairman of the convention.

The Branch voted to elect to membership MR. ROGER B. LANGSTON and to reinstate MR. RICHARD G. EVERS.

A. A. BENDERLY, *Secretary.*

BUFFALO BRANCH

The first meeting of the fall season was held at the Hotel Markeen, Buffalo on September 12.

About 40 members were present to hear Mr. Boris Joffe, a member of the Buffalo Branch give a talk on "Plating in France".

He stated that plating in France is not the high production industry it is here. Of about 750 job platers in France 450 of them are in Paris, with most of the shops employing a high percentage of women. These small shops are noted for their finishes on gold and silver. Mr. Joffe said that in many of the shops, the method of antique finishing is a family secret and is handed down for generations. Production plating in large plants is very much like ours in this country.

An interesting sidelight of the talk concerned polishing without greaseless compounds such as we use. In France a polishing compound is made up for the job usually being a composition of emery, coal oil and suet. In Mr. Joffe's opinion, in France polishing is superior to ours.

Members had many questions after the talk.

Ben Fortin, *Secretary*

CINCINNATI BRANCH

The Cincinnati Branch met on October 22, at the Engineering Society Headquarters with a fine turnout, both for dinner and the meeting.

During a routine business meeting discussion was centered on the Regional Educational Meeting and Dinner Dance. The Hotel Gibson has been reserved for March 28 and tickets for the dinner-dance will cost $7.50 per person. The temporary committee was dissolved and a new one appointed in its place with Charles Wise as General Chairman and Martin Gannon, Jr., as Co-Chairman. Ray Barry was appointed Chairman of the Educational Program, assisted by Stanley Garfinkel and Dick Evans; Charles T. Nuzum, Finance Chairman, and W. B. Stephenson, Jr., Banquet Chairman, assisted by Carl Truman.

The applications of Don Weaver and W. J. Ryan were presented to the membership, and both applicants were unanimously accepted.

Our speaker, Dr. R. B. Saltonstall of the Udylite Company was next presented. Taking "Nickel Plating Today and Tomorrow" as his subject, the speaker traced the early development of nickel plating and said that such operations started on a commercial basis in the 1870's in the stove and bicycle industries. He stated that the large demand by the military and atomic energy programs for nickel was responsible for the current nickel shortage. Dr. Saltonstall stated that the NAMF was the only organization representing the plating industry on the NPA, and had succeeded in getting the small amounts of nickel used.

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The speaker felt that white brass was a satisfactory substitute for nickel plating but left a lot to be desired. He was optimistic about the lessening of controls on nickel by the second quarter of 1953, and said that with the production of nickel constantly being increased, the present supply picture should change considerably in five years.

Dr. Saltonstall's remarks were concluded with the statement that heavy protective coatings of nickel will be developed in the future, particularly for the chemical and food processing industries. Nickel for electrotypes was also a possibility.

After an interesting question and answer period, the Udylite Company acted as hosts for our usual social hour.

CHARLES WISE, *Secretary*

HAMILTON BRANCH

The following officers have been elected by the Hamilton Branch for the 1952–1953 term:

President—J. W. BEATT
First Vice-President and Treasurer—H. FALLOWS
Second Vice-President and Secretary—R. BURKE
Third Vice-President and Librarian—H. CORNELL
Board of Managers—D. MUNDY, R. TURBALL, E. CRANSFIELD
Sergeant-at-Arms—C. LIVINGSTONE
Recording Secretary—J. HARDEN

HARTFORD BRANCH

A meeting was held at the Bond Hotel on October 20 with a good turnout of close to 100 members and guests. Preceding the meeting a color film entitled "California and Its Natural Resources" was shown.

The guest speaker of the evening was DR. VERNON A. LAMB, Chemist, National Bureau of Standards, whose subject was "Electroforming and Electropolishing".

Dr. Lamb outlined the factors that help one to decide whether an article can be electroformed or should be electroformed such as: (1) the shape of the article—both simple and complex articles can be electroformed. In many cases it may be simpler to electroform because the time spent in machining a part may be prohibitive; (2) the size of the article—almost any size can be done; (3) deposit thickness—here one has a wide variation, both thick or thin deposits can be made; (4) accuracy of reproduction—parts can be reproduced very closely, especially like molds or where a high finish is desired; (5) size of production run—sometimes where many steps are required as in deep drawing it may be cheaper to electroform. Various types of mandrels and separation techniques were discussed as were also the various metals used in electroforming. Samples of articles electroformed were displayed and slides were used to illustrate the talk.

MR. WILLIAM CULLEN of the Stanley Works Company was technical chairman

STANLEY PLATOZ, *Secretary*

INDIANAPOLIS BRANCH

On October 1, 34 members and guests enjoyed a steak dinner at Fox Steak House. At eight o'clock, six additional members joined the group for the business meeting and program. Reports of the secretary and the treasurer were accepted and filed.

Discussion followed as to the $1.00 assessment per member to be used for research committee. A motion was made by ED BRUCK that the branch delegates vote in favor of the $1.00 increase. Seconded by DR. A. M. MAX the motion was carried.

The scheduled program, a discussion on "Generators vs. Rectifiers" with Ed Bruck as moderator, was postponed until November.

RAYMOND SHOCK, executive secretary of NAMF, Washington, D. C., was our guest speaker. He told of his work with the association and how the association gives aid to platers nationally.

At 9:30 P. M. the meeting adjourned and refreshments were served.

EDNA ROHRABAUGH, *Secretary*

LANCASTER BRANCH

The Lancaster Branch held their Annual Ladies' Night meeting October 18 at the Arcadia Cafe, Lancaster, Pa. One hundred and forty-nine members and guests enjoyed a fine turkey dinner. There were presents for the ladies as well as numerous bingo and door prizes. A demonstration of hypnotism featured the evening's entertainment.

The Branch is greatly indebted to a number of its members as well as several suppliers who so graciously donated money and prizes to make the night a success.

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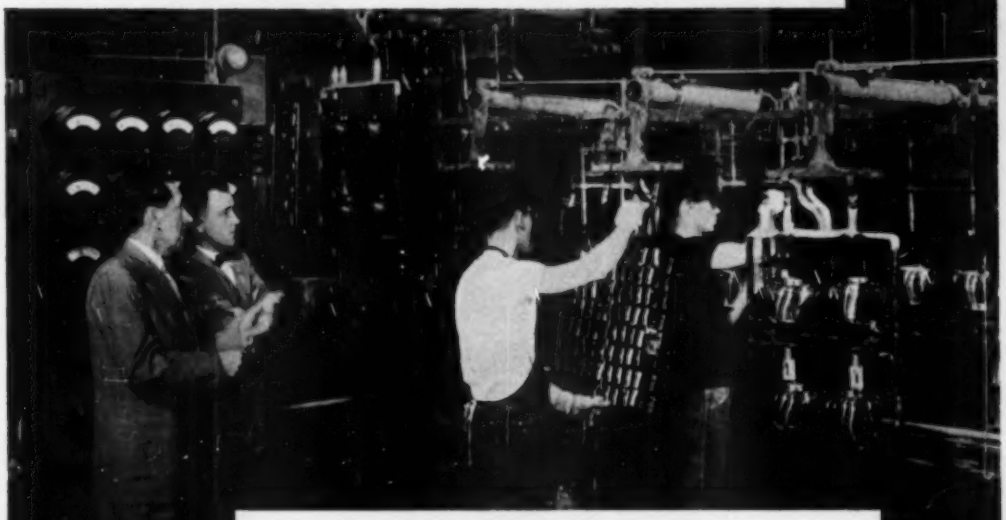

It's easy to see the advantages of this construction—double the capacity with the same machine. When less production is required only one rack is placed on each hanger arm—that's versatility, isn't it?

H-VW-M Full Automatic Conveyors are used daily for all types of plating—as well as anodizing, pickling, cleaning, phosphate coatings, bright dipping, painting, etching, and other finishing processes. They operate in a wide range of weight, current loads, and lifts. And they can be built with delayed set-down for varying immersion time, treatment by-pass mechanisms, air and solution agitation, racks with individual electrical control for each rack, or whatever special equipment the job requires—the ideal solution to problems of large quantity, high quality plating.

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Branch News

HARRY HOVIS served as Chairman of the committee in charge of arrangements.

H. A. SAYLOR, *Secretary*

LOS ANGELES BRANCH

A regular monthly meeting of the Los Angeles Branch was held at Rodger Young Auditorium September 10, with 65 members and guests in attendance.

The Research Committee Chairman, EARL COFFIN, announced the application of the Alert Supply Company and Metallon Products, both of Los Angeles, as sustaining members. The report of the annual summer picnic attended by over 150 members and guest was covered by FRED RAYMOND and FRED HERR.

LIBRARIAN STUART KRENTEL introduced the speaker of the evening, MR. H. E. DONALDSON, General Chemical Company, who spoke on "Fluoborates in the Plating Room". He pointed out that while many metals are soluble in fluoboric acid, the light metals such as sodium and potassium, are not soluble; and that fluoborates as such do not etch glass. He also noted that fluoboric acid has come into prominence in the pickling field due to the fact that most of the metal fluoborate salts formed in pickling are soluble, and no insoluble residues are left on the surface of the parts to give trouble in later plating or metal finishing operations. This is particularly important where lead and its alloys must be pickled, and consequently, fluoboric acid is used in pickling and acid dipping of stereotypes, Brittania metal, die castings, brass and aluminum.

The lead and lead-tin fluoborate plating baths have gained considerable prominence in plating such diversified products as bearings, pistons, battery parts, and radio chassis. The tin fluoborate bath produces deposits which replace the flowed tin coatings often used in electrotyping and is also used in wire plating. Copper fluoborate baths are used on rotogravure rolls, electrotypes, record matrices, baby shoes, and plastics. Nickel cadmium, iron and indium fluoborates are all used extensively in the metal finishing industry due to their special properties.

Mr. Donaldson also brought out that nearly all of the fluoborate baths are characterized by their high conductivity, high average current density plating range, freedom from anode polarization, high efficiency, high stability, and ease of control.

Plating tanks and filters for handling fluoborates should be lined with rubber or one of the approved plastic materials. Heat exchangers of Karbate, Durimet or equal materials are satisfactory for temperature control. Organics in these baths produce brittleness if excessive amounts are present, but they can be removed with carbon, making sure that no silica type filter aids are present.

An active question and answer period followed Mr. Donaldson's talk, showing that the varied properties of the fluoborates had created considerable interest from the viewpoint of the metal finishers in attendance.

EARL W. ARNOLD, *Secretary*

LOUISVILLE BRANCH

A regular monthly meeting was held September 18, at Korfhage's Restaurant, 1482 Preston Street, Louisville, with a dinner served at 6:30 P. M. PRESIDENT ARTHUR A. OERTEL opened the meeting at 8:00 P. M. with 34 members and guests present.

During a routine business meeting, three new members were elected: KENNETH C. REIFSTECK, NORMAN W. JOHNSON and WILLIAM W. FRANCIS.

S. J. BEYER gave a brief report of the Chicago Convention and comments were also offered by ED BRUCK of the Indianapolis Branch.

President Arthur A. Oertel appointed the following to serve as a member to each committee:

R. K. MARTIN—*Membership Committee*
EARL BENNETT—*Sick Committee*

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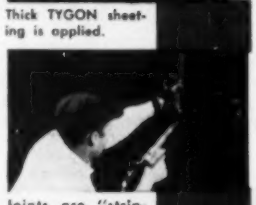

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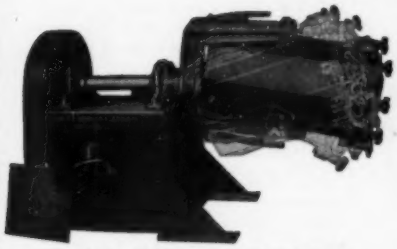

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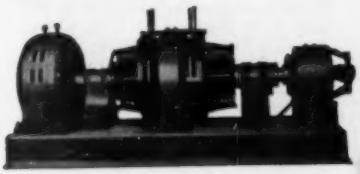

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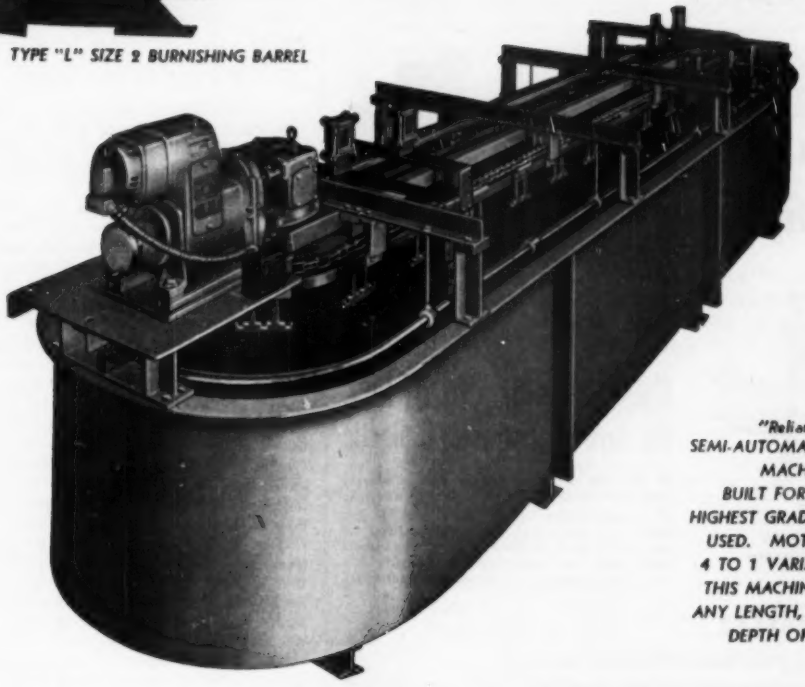

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Branch News

RAY DANIELS—*Publicity Committee*
PAUL DEHAVEN—*Technical Sessions Committee*

The resignations of JAMES HAHN and CHARLES T. STOECKER and the transfer of H. D. JONES to the St. Louis Branch were announced.

Technical Sessions Chairman, S. J. Beyer, introduced the speaker of the evening, A. H. KIRKPATRICK, F. B. Stevens Company, Inc., Detroit, Mich., whose talk on the subject of Material Handling, Plating and Phosphatizing of small parts, explained the superiority of the automatic barrel plating machine as compared to hand barrel plating by saving in labor from 40 to 60 per cent. In "Industrial Albums" a film accompaniment, efficient operations of the barrel plating machine with its tremendous capacity and the flexibility of adjustment to plate any desired thickness was demonstrated.

Considerable discussion followed and Mr. Kirkpatrick was given a rising vote of thanks for a very interesting talk and picture.

Refreshments were served through the courtesy of the F. B. Stevens Company.

Meeting adjourned at 10:30 P. M.

JOSEPH G. STERLING,
Secretary-Treasurer

MELBOURNE BRANCH

The 74th regular meeting held on October 16 was attended by 42 members and visitors at the Melbourne Technical College.

After an introduction of half an hour of an interesting film, "Steel", which was made available and screened by MR. G. WALKER, the speaker for the night, PROFESSOR H. K. WORNER, Professor of Metallurgy, Melbourne University, was introduced by MR. J. DALE. Illustrating with slides, the speaker gave an informative address on "Metals Through the Ages", dating from the Stone Age to present Atomic Age, beginning at the cradle of native metals, East Asia.

Early iron smelting was discussed, and important years in modern steel making, 1857–1865, were years of Bessemer crucible and Sieman Brothers open hearth processes, which are the forerunners of today's steel manufacture.

It was not until the early 20th Century, when electric currents were beginning to be understood, that electrodeposition and electroplating began to be commercial projects.

After questions were put to the speaker by members, MR. R. TAYLOR thanked Professor Worner for his most interesting address.

The meeting closed at 10:10 P. M.

S. B. PEARCE, *Secretary-Treasurer*

MONTREAL BRANCH

The first regular meeting of the 1952–1953 term of the Montreal Branch was held in the Mount Royal Hotel on September 9.

The meeting was called to order by PRESIDENT G. R. KING at 8:50 P. M. with a welcome to the 37 members and guests present. Among the out-of-town visitors welcomed was MR. NICK SEDELNICK of the Acme Shear Company, Bridgeport, Conn.

LIBRARIAN P. M. COADY introduced MR. E. T. CANDEE, Lea Manufacturing Company, Waterbury, Conn., guest speaker of the evening, who spoke on the various benefits to be derived from the use of liquid buffing compositions. This type of composition apparently makes for easier cleaning, because less deposit is left on the work. Areas where buffing is done are kept cleaner due to better adherence of liquid compositions to buff surface. Mr. Candee concluded in saying that in certain cases almost double the amount of liquid composition will adhere to the buff in comparison to the same weight of composition in bar form.

MR. CHARLES DOUGLAS thanked the speaker on behalf of the Montreal Branch for a very interesting and educational talk.

NORMAN GREGSON, Armalite Ltd., and JOHN RENNIE, Diversey Corporation of Canada Ltd., were elected to membership.

J. T. REISENBURG, JR., *Secretary*

NEWARK BRANCH

A regular meeting was held September 17, at the Robert Treat Hotel, PRESIDENT ROBERT EBERHARDT presiding.

During the routine business session the applications for membership of A. LOUIS BOSIO, HUGH MCGUIRE and WILLARD RILEY were submitted. MARTIN KAPLAN was elected to membership. WILLIAM

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LALETIN and FRED NOBEL were transferred to the New York Branch and D. C. HAMILTON and H. JOHNSON were suspended.

The members were very enthusiastic over the new meeting announcements called "Newark Sparks". They expressed their desire to continue under this name until a better one is selected. Credit for this paper goes to DON FOULKE and AL KORBELAK.

PRESIDENT F. J. MACSTOKER of the Supreme Society honored us with his presence. He spoke of the growth of the Society with a membership of over 5,000 members, and emphasized the growth of the magazine PLATING.

HAROLD SMALLMAN, of Chicago, a former member of Newark Branch, was called on and he responded with a few well chosen words.

LIBRARIAN THOMAS AUSTIN introduced the speakers of the evening, WALTER PRINE and DR. MAY of the International Nickel Company, who presented a wonderful color motion picture film, "Corrosion in Action".

One hundred and four members and friends adjourned for refreshments at 10:55 P. M.

GEORGE REUTER,
Recording Secretary

PHILADELPHIA BRANCH

The fall and winter meetings of the Philadelphia Branch got off to a fine start with a dinner meeting at the Broadwood Hotel on September 26 that featured the annual Gehling Memorial Lecture. More than 50 members and guests attended.

DR. ALLEN E. CHESTER, Vice-President of the Promat Division, Poor and Company, talked on the subject of "White Brass". He gave a brief history of high zinc–low copper alloy plating and the development of additions to produce bright coatings. At the present time, about 400,000 gallons of white brass solutions are in use by industries that have not been permitted to use bright nickel.

A typical white brass formula in wide use was given. Close temperature control between 65–70° F is necessary, as is constant filtration. The anodes may be cast alloy or entirely zinc, in which case the copper is supplied by the solution; dual anodes are not in use. The anode current density of 30 to 35 asf must be closely controlled. The brighteners are of the two class system used in bright nickel—a grain refiner and a carrier. Brightener control is by the Hull Cell. The cost when close control is maintained was given as 20 per cent less than a copper-nickel-chrome system. However, if only empirical control is used, it can be expected that the cost will be several times higher.

Before chrome plating, the strongly basic film on the white brass surface must be completely removed, which is done by rinsing in a 1 to 2 per cent solution of acetic acid. The chrome solution should be operated between 125–150/1 CrO_3-SO_4 ratio; the proprietary chrome solution now in use works well.

Large installations of bright white brass (5,000 gallons and over) have been operating with success where the corrosion resisting characteristics of a film thickness of from 0.00015 to .0002 inches have been satisfactory for the end use. Small baths (from 100 to 400 gallons) have not been very successful due to sudden changes in composition and operating conditions. Dr. Chester commented that it was a chemist's and not a plater's bath.

Deposits heavier than previously mentioned are brittle due to addition agent occlusion. For this reason, bright white brass is not satisfactory for severe exposure conditions, as in the automotive field, but works quite well for indoor surfaces, as on hand tools and tubular furniture. In the latter application, exposure to salt spray produces white corrosion in 20 to 25 hours and red rust in 90 to 100 hours.

By raising the copper content to 30 per cent, and with the proper addition agents, a more ductile deposit is produced. However, the deposit is not bright but semigloss; it buffs very readily, flows well and does not cut through easily. In control, it is similar to bright zinc. The operating temperature is 70° F; air agitation is used; the current density is up to 60 asf, with no normal working defects over a wide C.D. range. It has excellent throwing power; cathode efficiency of 85 per cent; M ratio—2.5; a higher caustic content than the bright solution; its ammonia content must be replaced after the bath has not been operated for a while. Deposits of 0.001 to 0.002 inches are ductile and may be buffed with a high flanged loose 16-inch wheel, using a lime composi-

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tion. It chrome plates readily and costs about 50 per cent of a copper-thin nickel-chrome system. When applied over steel, it protects by sacrificial corrosion, with the following results after salt spray exposure: fine, white corrosion—80 to 100 hours; red rust—200 hours. It has a high heat resistance, being heated to 700 to 750° F without discoloration. Solutions as low as 100 gallons work satisfactory, as brightness is not critical. Its toxicity as applied to food containers is not known, although it is not as corrodible by food acids as zinc. It is recommended in applications where buffed copper is now used.

In reply to a question, Dr. Chester stated that both solutions are being used for barrel plating followed by the parts being ball burnished.

The Branch is very glad of the opportunity it had in hearing Dr. Chester's fine talk on white brass, which not only gave the advantages but also the shortcomings of this timely subject.

The short business meeting conducted prior to the lecture heard reports on the 1953 Convention, the annual banquet and educational session to be held on November 22, and the Branch instructed its delegates to vote in favor of the dues increase amendment.

I. Wm. Marcovitch, *Secretary*

PITTSBURGH BRANCH

The Pittsburgh Branch held its regular meeting at the Sheraton Hotel on October 9. Twenty-seven of our members enjoyed a delicious meal prior to the business meeting, and a near record attendance of 50 members and guests took part in the technical session.

Glenn Herring reported on the progress of our November "Milwaukee Party" Night.

Our good friend, Bill Hennessey, now a member of the Philadelphia Branch, was a most welcome guest and gave us a report on the work that the Philadelphia National Convention committee has been doing.

We were very happy to welcome 4 new members into the Branch: Albert Hart, G. K. Garrett Company; Angelo Certo, Standard Steel Spring Company; Michael Vucich, Weirton Steel Company and Robert W. Bishoff, Standard Steel Spring Company.

Ed Smith read a letter from the Chicago Branch requesting our support for the proposed change in By-Laws calling for a dollar dues increase to be used for Research. Sam Johnston made a motion seconded by Leslie Lancy that our delegates be instructed to vote for this proposed change.

Ed Washburn introduced our speaker for the evening, Dr. Walter R. Meyer, Enthone, Inc., New Haven, Conn. The subject on which Dr. Meyer spoke to us was "Adhesion of Electrodeposits and New Methods of Oxide Removal and Cleaning". The use of slides accompanied by a running commentary made the talk interesting both to the technical men and the practical platers present. A lively question period followed the main talk and a standing ovation was given to Dr. Meyer in appreciation of his fine presentation.

R. H. Schindler, *Secretary*

SAGINAW VALLEY BRANCH

Sixty-five members and guests attended the second Fall meeting, October 8, at Zehnder's Hotel in Frankenmuth, Mich.

The membership committee introduced 10 visitors who wished to become members. A vote was taken and the following gentlemen were accepted into the Saginaw Valley Branch: Leo C. Mangett, John S. Smith, Dale V. Burdy, Emery F. Gravelle, Jr., John C. Davis, Patrick H. Kehoe, Jr., Oran E. Crisler, E. P. Walsh, Roy E. Clements, Charles A. Reid.

Mr. Brisson, Librarian, introduced the speakers for the evening, Dr. Kellner and Mr. B. D. Ostrow of Ronal Chemicals, Inc. They gave very interesting talks on Bright Copper and Bright Silver Plating and included slides of Hull Cell tests to clearly illustrate their points. A question and answer session followed, after which the meeting was adjourned.

D. W. Snyder,
Recording Secretary

ST. JOSEPH VALLEY BRANCH

A regular meeting was held at Champ's Hotel, Dowagiac, Mich., on October 1. This first meeting of the Fall season was the occasion of an inspection trip through the Kaiser-Frazer plant at Dowagiac.

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Branch News

There was a record attendance of 68 members and guests.

After an excellent dinner, the meeting was called to order by PAST PRESIDENT Dr. ERNEST WILHELM, who called upon our honorary member, MR. JOHN LOCKERBIE to install the new President, MR. RICHARD C. LOCKERBIE, his son, which he proceeded to do in a very fine manner. He presented him with a gavel which was of great sentimental value to him. It was the gavel which had been given OSCAR SERVIS when he was installed as National President in 1916, and which Mrs. Servis had given him on the death of her husband.

The meeting was then turned over to LIBRARIAN RALPH BROUWER, who then introduced LEO DAVIES, Chief Chemist, and BOB GREGG, Laboratory Director, of Kaiser-Frazer Manufacturing Company. They outlined and discussed the high points of our inspection trip. In particular, they gave us details of the waste disposal plant which had been installed in connection with their plating plant.

The plant made a very favorable impression on the visitors due to its orderliness and excellent arrangement of equipment. It was immediately apparent that all plating done there was of a precision nature and that the high value of the parts being plated made it important to keep scrap and spoilage to a minimum.

The group showed considerable interest in the tanks and filtering arrangement of the waste disposal system.

The inspection tour was completed at 10:00 P. M. and the group adjourned, voicing their appreciation for the opportunity of visiting the Kaiser plant.

EUGENE ROTH,
Secretary-Treasurer

SYDNEY BRANCH

The 87th general meeting was held at the Trust Building, King and Castlereagh Streets, Sydney, on October 9. Twenty members and 7 visitors attended this meeting in which MR. J. J. DALE, who is in charge of the Electroplating Division at D. R. L. Maribyrnong, gave a talk on "Some Aspects of Quality Control in Plating".

Better plating is needed but first bad plating must be eliminated said Mr. Dale. Obvious defects were not dealt with as platers are quite capable of dealing with them, but hidden defects were the main points that were spoken about.

Adequate "thickness" is a must for severe conditions and this has been proved over and over again, hence we find that thickness is the first consideration in specifications. "Porosity" is a big problem and this must be overcome if corrosion of the base metal is to be stopped.

In too large a proportion of plated work adhesion is only apparent and coatings separate under severe tests. In nearly all these cases the fault lies in the preparation. Cleaning must be perfect; overcleaning can be as bad as undercleaning and this causes the metal to become oxidized or leaves a film on the surface. Proper etching is vital and is the key to good adhesion as it removes the tarnish and oxide films and secondly it removes the disturbed surface which is always left after polishing operations.

For the remainder of the lecture the speaker showed slides of general interest including examples of electropolishing and details for Bright Silver plating using P.R. current.

A vote of thanks to Mr. John Dale was moved by ERNIE WRIGHT and seconded by Mr. BEN ARMSTRONG.

R. BRIDGEMENT,
Secretary

TWIN CITY BRANCH

The following have been elected to serve as officers of the Twin City Branch for the term 1952–1953:

President—JEROME M. WELLER
First Vice-President—PAUL R. HESSE
Second Vice-President—GEORGE C. REED
Librarian—FRED J. KIAM
Secretary-Treasurer—ROBERT L. BUCKLEY
Board of Managers—JEROME M. WELLER, PAUL R. HESSE, GEORGE C. REED, FRED J. KIAM, ROBERT L. BUCKLEY, BEN J. ROSENTHAL, ADOLPH LEVINE, D. WRAY SCHOBB, FRANK KILPATRICK

ROBERT L. BUCKLEY,
Secretary-Treasurer

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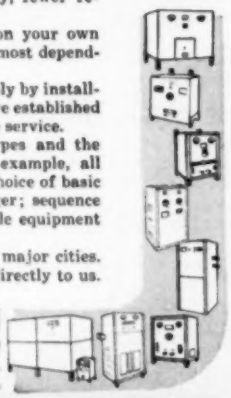

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The Magne-Gage is a versatile, easy-to-use instrument for accurately measuring coatings on convex, concave, or plane surfaces, without destroying either the coating being measured or the base material. Modified Magne-Gages can be supplied to measure coatings on inside surfaces of tubes, pipes, etc. Less than 45 seconds are required to take a reading, and an accuracy of better than 10% full-scale is assured. Operation is based on the magnetic attraction of a permanent magnet to the material being measured and/or its backing, thus no electrical circuits are involved and no auxiliary equipment is required.

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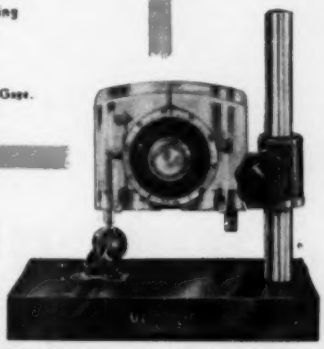
Coating on cylindrical object being measured with the Magne-Gage.



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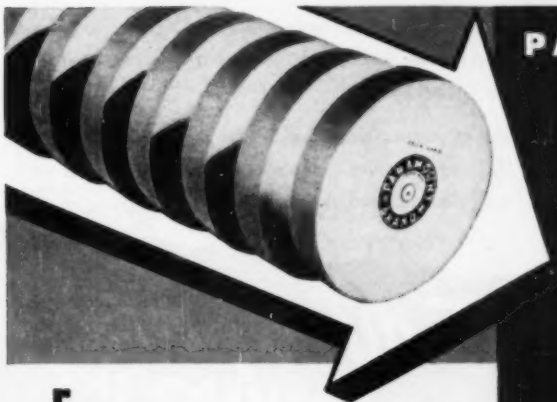

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Stubs, average length _____ inches
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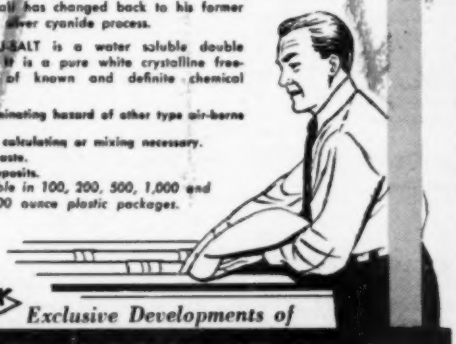

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Membership Competition

BRANCH	Membership Apr. 1, 1952*	New Members	Net Change in Membership	Per Cent Net Change
First Group				
Toronto	132	12	+12	+ 9.1
Milwaukee	145	15	+13	+ 9.0
New York	305	17	+14½	+ 4.8
Newark	240	14	+10½	+ 4.4
Bridgeport	154	3	+ 3½	+ 2.3
Hartford	148	6	+ ½	+ 0.3
Detroit	500	26	+ ½	+ 0.1
Pittsburgh	132	12	0	0
Boston	140	..	.....	.....
Grand Rapids	155	4	− 2½	− 1.6
Cleveland	212	12	− 3½	− 1.7
Chicago	469	40	−14½	− 3.1
Melbourne†	168	18	− 9	− 5.4
Los Angeles	218	1	−13	− 6.0
Philadelphia	203	4	−18	− 8.9
Second Group				
Saginaw Valley	71	14	+14	+19.7
Rochester	88	20	+13	+14.8
Montreal	72	7	+ 6	+ 8.3
Cincinnati	80	6	+ 6½	+ 8.1
New Haven	88	6	+ 7	+ 8.0
Syracuse	104	10	+ 1	+ 1.0
Buffalo‡	107	4	0	0
St. Louis	102	..	.....	.....
Waterbury	115	..	− 1½	− 1.3
Baltimore-Washington	96	5	− 2½	− 2.6
St. Joseph Valley	74	2	− 3	− 4.1
Dayton	81	7	− 3½	− 4.3
Providence-Attleboro	92	4	− 6	− 6.5
Sydney	86	2	− 7	− 8.4
Indianapolis	114	3	−10	− 8.8
Rockford	79	3	−15	−18.9
Third Group				
Wichita	...	12 (19)	+12	+63.2
Louisville	24	12	+10	+41.7
Western Ontario	19	8	+ 4	+21.1
Toledo	39	4	+ 7½	+19.2
San Francisco	67	10	+10	+14.9
Hamilton	22	3	+ 3	+13.6
Kansas City	...	4 (34)	+ 4	+11.8
Adelaide	58	6	+ 6	+10.3
Allentown-Reading	44	4	+ 4½	+10.2
Southeastern	47	13	+ 4½	+ 9.6
Dallas-Fort Worth§	69	13	+ 5½	+ 8.0
Springfield	55	3	+ 3	+ 5.5
Jackson-Lansing	59	4	+ 3	+ 5.1
Lancaster	67	4	+ 2	+ 3.0
Twin City	66	6	0	0
Houston	40	..	.....	.....
Columbus	54	5	− 3½	− 6.5
Outside Competition				
At Large	125	10	+10½	.....
In Transfer	23	..	.....	.....
Total A. E. S.	5,748	398	+79	+ 1.4

Active Membership, September 30, 1952 5,827

*Subject to correction. †, ‡, §Winners in first, second and third group, respectively, of 1951-1952 membership competition.

SOUTHEASTERN: Charles L. Anger, Frank O. Bates, Nelson F. Graves, W. Gray Hampton
SYRACUSE: Arthur Eisner, Joseph F. Gilbert, Francis F. Mariano
TORONTO: Harry Bird, Rexford F. Faithfull, Robert C. Hess, Alexander T. Patterson, Arthur A. Peck
WESTERN ONTARIO: Stanley Schram, Hugh C. Stonehouse, Larry Wilcocks
MEMBER-AT-LARGE: Dave duPlessis, Johannesburg, South Africa; Stephen Hebel, Calcutta, India; Howard M. Peckham, Fort Worth, Texas

Reinstatements

LOS ANGELES: William A. Nairn, Marvin J. Noblett
PHILADELPHIA: David Polsky, Arthur G. Snow
ST. JOSEPH VALLEY: Kenneth Harlan
TOLEDO: Eugene Rzymek
TWIN CITY: D. C. Thom (Suspended in error)

TRANSFERS

Ellis D. Hunter from Lancaster to Allentown-Reading; Joseph H. James from Philadelphia to Baltimore-Washington; Raymond M. Shock from Detroit to Baltimore-Washington; William A. Zube from Saginaw Valley to Chicago; Robert J. Rowe to Bridgeport from Detroit; Russel Fancher from Detroit to Grand Rapids; George W. Bartle from Pittsburgh to Los Angeles; Chester Borlet to Detroit from Los Angeles; W. G. Lidtke from Detroit to Los Angeles; Arthur M. Linn from Detroit to Milwaukee; Harold Grutter from Grand Rapids to Toledo

Resignations

DETROIT: Robert N. Lipson
GRAND RAPIDS: Otto J. Klingenmaier, Forrest Bissel

Suspensions

BALTIMORE - WASHINGTON: Reginald A. Biser, James E. Boback, J. P. Cadden, Charles W. Clark, John J. Slattery
BUFFALO: W. E. Leney, Jr.
CHICAGO: A. A. Becker, John E. Cummings, Harold A. Delihant, George J. Feiden, J. C. Hampson, W. E. Karry
DETROIT: Sigmund Sobson
GRAND RAPIDS: Franz M. Thompson, Thomas J. Wallace
PITTSBURGH: Elmer T. Busch, Douglas L. Carle, Joseph P. Crookshank, Robert T. Graf, Albert A. Klein, Harold K. Stiffler, K. H. Strader

Deaths

BALTIMORE-WASHINGTON: Harris M. Lyen
CHICAGO: Ralph Fosnacht, James J. Manderscheid
SYRACUSE: Russell O. Warner

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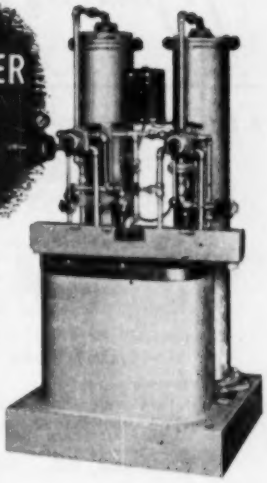

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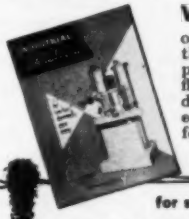

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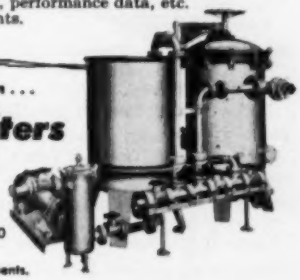

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Secretary.....The Executive Secretary

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BALTIMORE-WASHINGTON meets second Tuesday of each month with meetings in Baltimore at the Engineers' Club and in Washington, D. C., at the National Bureau of Standards. Secretary, Asaf A. Benderly, 1829 Summit Place, N. W., Washington 9, D. C.

BOSTON meets first Thursday of each month in Hotel Statler. Secretary, Dr. George P. Swift, 53 Galen Street, Watertown 72, Mass. Research Finance Committee Chairman, Louis V. Gagnon, 53 High Street, Natick, Mass.

BRIDGEPORT meets second Friday of each month in Barnum Hotel. Secretary-Treasurer, Robert G. Parker, 25 Beverly Road, Trumbull 58, Conn.

BUFFALO meets first Friday of each month in Markeen Hotel. Secretary and Research Finance Committee Chairman, B. P. Fortin, Jr., 209 Forest Drive, Orchard Park, N. Y.

CHICAGO meets second Friday of each month at 8 P. M. at Western Society of Engineers, 84 E. Randolph Street. Secretary-Treasurer, Paul Glab, 862 N. Paulina Street, Chicago, Ill. Research Finance Committee Chairman, William B. Johnson, c/o Industrial Filter & Pump Manufacturing Company, 5914 Ogden Avenue, Chicago 50, Ill.

CINCINNATI meets fourth Wednesday of each month at 8 P. M. in Engineering Society Headquarters, McMillan Street and Woodburn Avenue. Secretary, Charles Wise, c/o The Buckeye Products Company, 7020 Vine Street, Cincinnati 16, Ohio.

CLEVELAND meets first Friday of each month in Hotel Carter at 8 P. M. Secretary-Treasurer, A. J. Lupien, 4408 Carnegie Ave., Cleveland 3, Ohio. Research Finance Committee Chairman, John D. Little, c/o The Harshaw Chemical Company, 1945 E. 97th Street, Cleveland 6, Ohio.

COLUMBUS meets first Friday of each month at 8 P. M. in Battelle Memorial Institute Auditorium. Secretary-Treasurer, John Soderberg, 40 W. Long Street, Columbus, Ohio. Research Finance Committee Chairman, Fred Brune, R. D. 7, Marion, Ohio.

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DETROIT meets first Friday of each month in Hotel Statler. Secretary-Treasurer, Joseph Guraki, 8885 Littlefield, Detroit 28, Mich. Research Finance Committee Chairman, Bruno Leonelli, 238 Rhode Island, Highland Park 3, Mich.

GRAND RAPIDS meets second Friday of each month at 7:00 P. M. for dinner; educational session at 8:15. Meeting place to be announced. Secretary, Kenneth Hampel, 136 Elwood Street, Grandville, Mich. Research Finance Committee Chairman, J. D. Kershaw, Jr., 904 Mayhew Wood, S. E., Grand Rapids, Mich.

HAMILTON BRANCH meets third Thursday of each month in the Conference Room, West End Plant, Canadian Westinghouse Company, Ltd. Secretary, R. Burke, c/o Swift Devices, 14 George Street, Hamilton, Ontario, Canada.

HARTFORD meets third Monday of each month in Hotel Bond. Secretary, Stanley Platoz, 26 Erwin Place, New Britain, Conn. Research Finance Committee Chairman, Frank W. Smith, 46 Cottage Street, Meriden, Conn.

HOUSTON meets third Tuesday of each month at 7:30 P. M. Secretary-Treasurer, C. A. Mattiza, P. O. Box No. 9312, Houston, Texas.

INDIANAPOLIS meets first Wednesday of each month at Fox Steak House, 1207 E. Washington Street. Secretary, Miss Edna Rohrabaugh, 816 Robert Street, Lafayette, Ind.

JACKSON-LANSING meets second Tuesday of each month alternating between Meadow Lark Inn in Jackson and Porter Hotel in Lansing. Secretary-Treasurer, W. H. Mogle, 1623 Wildwood, Jackson Mich. Research Finance Chairman, J. H. Hoefer, 5440 Meridian Road, R.R. 6, Jackson, Mich.

KANSAS CITY—Secretary-Treasurer, Olin K. Bock, 5317 W. 58th Street, Mission, Kansas.

LANCASTER meets second Friday of each month at 8 P. M. in Thaddeus Stevens Industrial School. Secretary-Treasurer, Harry A. Saylor, 40 N. Poplar Street, Elizabethtown Pa. Research Finance Committee Chairman, Harry Hovis, Lincoln Highway, West Lancaster, Pa.

LOS ANGELES meets second Wednesday of each month at 6:30 P. M. in Rodger Young Auditorium. Secretary, Earl W. Arnold, 3628 E. Olympic Boulevard, Los Angeles 23, Calif. Research Finance Committee Chairman, Earl Coffin, 5102 Marburn Avenue, Los Angeles 43, Calif.

LOUISVILLE meets third Thursday of each month in Room 119, Speed Scientific Building, University of Louisville. Secretary-Treasurer, Joseph G. Sterling, 1169 Keller Avenue, Louisville, Ky. Research Finance Committee Chairman, T. K. Allison, 301 W. Main Street, Louisville 2, Ky.

MELBOURNE, AUSTRALIA meets third Thursday of each month at 8 P. M. in Metallurgy Theatre, Melbourne Technical College, 124 Latrobe Street. Honorary Secretary-Treasurer, S. B. Pearce, G. P. O. Box 4591, Melbourne, Australia.

MILWAUKEE meets first Friday of each month in the East Room, Hotel Ambassador. Secretary-Treasurer, E. E. Pierlusch, 2921 S. 90th Street, West Allis 14, Wis. Research Finance Committee Chairman, T. D. Hartshorn, 4818 N. Woodruff Avenue, Milwaukee 11, Wis.

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PHILADELPHIA meets fourth Friday of each month in Harrison Laboratory Building, University of Pennsylvania, 34th and Spruce Streets. Secretary, I. William Marcovitch, 1434 Lardner Street, Philadelphia 24, Pa. Research Finance Committee Chairman, Brooks Ricca, 332 Lantwyn Lane, Narberth, Pa.

PITTSBURGH meets second Thursday of each month in the Avon Room of Sheraton Hotel. Secretary, R. H. Schindler, 125 Fairfax Road, Forest Hills, Pittsburgh 21, Pa. Research Finance Committee Chairman, S. S. Johnston, c/o Weirton Steel Company, Weirton, W. Va.

PROVIDENCE-ATTLEBORO meets third Monday of each month in Providence Engineering Society Hall, 195 Angell Street, Providence, R. I. Secretary, George A. Gibbs, 65 Farragut Avenue, Providence, R. I. Research Finance Committee Chairman, Pierre B. Lonsbury, 78 North Avenue, Attleboro, Mass.

ROCHESTER meets third Monday of each month at the Forty Over Eight Club, 933 University Avenue. Secretary, Edwin Wallin, 70 Peach Tree Road, Penfield, N. Y. Research Finance Committee Chairman, Cecil Thornton, 20 Lafayette Parkway, Rochester, N. Y.

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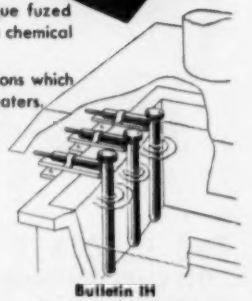

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ST. JOSEPH VALLEY meets first Wednesday of each month at 8 P. M. in Hotel Elkhart, Elkhart, Ind. Secretary-Treasurer, Eugene Roth, 1720 Mishawaka Avenue, South Bend 15, Ind. Research Finance Committee Chairman, William McDowell, 211 Sycamore Street, Elkhart, Ind.

ST. LOUIS meets second Wednesday of each month in American Hotel, 7th and Market, St. Louis Mo. Secretary-Treasurer, E. R. Hunleth, 4415 Michigan Avenue, St. Louis, Mo. Research Finance Committee Chairman, Dale Bolyard, 1803 Alfred Street, St. Louis 10, Mo.

SAN FRANCISCO meets third Thursday of each month, alternating between St. Julien Restaurant, 140 Battery Street, San Francisco, and El Curtola Restaurant, 510 17th Street, Oakland. Secretary-Treasurer, Horace J. Smith, 319 Alta Loma Drive, South, San Francisco, Calif. Research Finance Committee Chairman, Alan Baker, 10 Bluxome Street, San Francisco, Calif.

SOUTHEASTERN meets second Friday of each month in the Georgia Hotel, Atlanta, Ga. Secretary-Treasurer, W. T. Weymouth, 173 Clay Street, S. E., Atlanta, Ga. Research Finance Committee Chairman, Dr. Fred Cox, Georgia School of Technology, Atlanta, Ga.

SPRINGFIELD meets fourth Monday of each month in Hotel Charles. Secretary, R. J. Girard, 145 Waite Avenue, Chicopee Falls, Mass. Research Finance Committee Chairman, James Laing, c/o Van Valkenburg Company, Montgomery Street, Willimansett, Mass.

SYDNEY, AUSTRALIA meets second Thursday of each month at 7:30 P. M. in the Trust Building, King and Castlereagh Streets. Secretary-Treasurer, R. Bridgement, 19 Adelaide Street, Belmore, Sydney, N. S. W., Australia.

SYRACUSE meets third Monday (each month in Loyal Order of Moose Hall, 643 W. Onondaga Street. Secretary, Lindley Wood, 1329 Bellevue Avenue, Syracuse 4, N. Y. Research Finance Committee Chairman, George V. Cavanaugh, 129 Kenwood Avenue, Syracuse, N. Y.

TOLEDO meets first Thursday of each month at Commodore Perry Hotel. Secretary, Gaston Bergeman, 703 Pine Street, Fremont, Ohio.

TORONTO meets second Friday of each month in Royal York Hotel. Secretary, Robert L. Edwards, 1106 Duvercourt Road, Toronto, Ont., Canada. Research Finance Committee Chairman, C. D. Short, 1281 Pape Avenue, Toronto, Ont., Canada.

TWIN CITY meets first Monday of each month, October through June, in the Covered Wagon (Lodge Room), 114 S. 4th Street, Minneapolis, Minn., with dinner at 7:00 P. M. and business and technical session at 8:00 P. M. Secretary-Treasurer, Robert L. Buckley, c/o Industrial Chemical & Equipment Co., 205 11th Avenue So., Minneapolis 15, Minn. Research Finance Committee Chairman, E. H. Lindemann, c/o Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

WATERBURY meets second Thursday of each month in Elton Hotel. Secretary-Treasurer, Spencer L. Henn, P. O. Box, Dr. B, Cheshire, Conn.

WESTERN ONTARIO meets third Friday of each month in William Pitt Hotel, Chathom, Ontario. Secretary-Treasurer, K. W. Farquhar, c/o Wallaceburg Brass, Ltd., Wallaceburg, Ontario, Canada.

WICHITA—Secretary-Treasurer, Harry D. Burgess, 2302 Jardine, Wichita, Kans.

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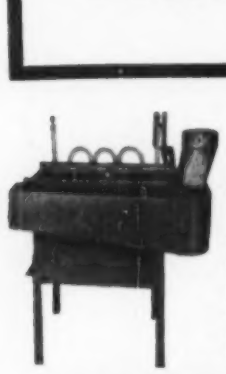

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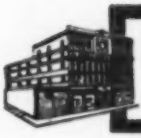

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AMERICAN INSTITUTE OF CHEMICAL ENGINEERS' Annual Meeting, Cleveland, Ohio, December 7–10.

NEWARK BRANCH, A. E. S., Annual Educational Session on December 12 at 8:00 P. M., and Christmas Party and Banquet on December 13 at 7:00 P. M., both in the Robert Treat Hotel.

ROCHESTER BRANCH, A. E. S., Annual Christmas Party at the Leiderkrantz Club on December 20, 1952.

GRAND RAPIDS BRANCH, A. E. S., Annual Educational Session (2:00 P. M.) and Banquet (7:00 P. M.) at the Pantlind Hotel on January 24, 1953.

CHICAGO BRANCH, A. E. S., Annual Banquet and Educational Session in the Grand Ballroom of the Conrad Hilton Hotel on January 31, 1953.

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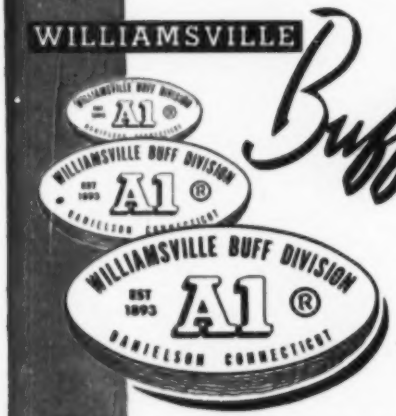

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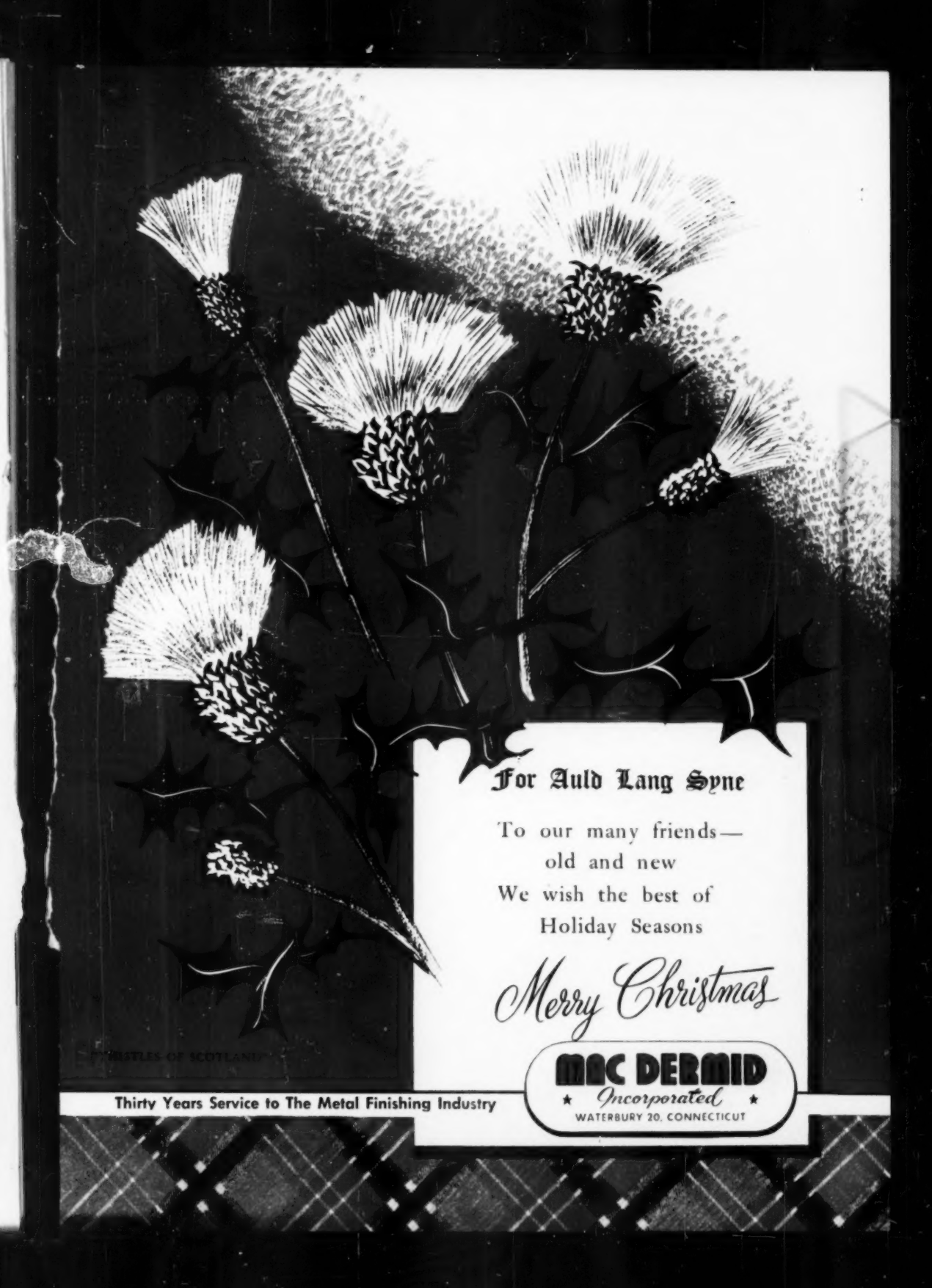
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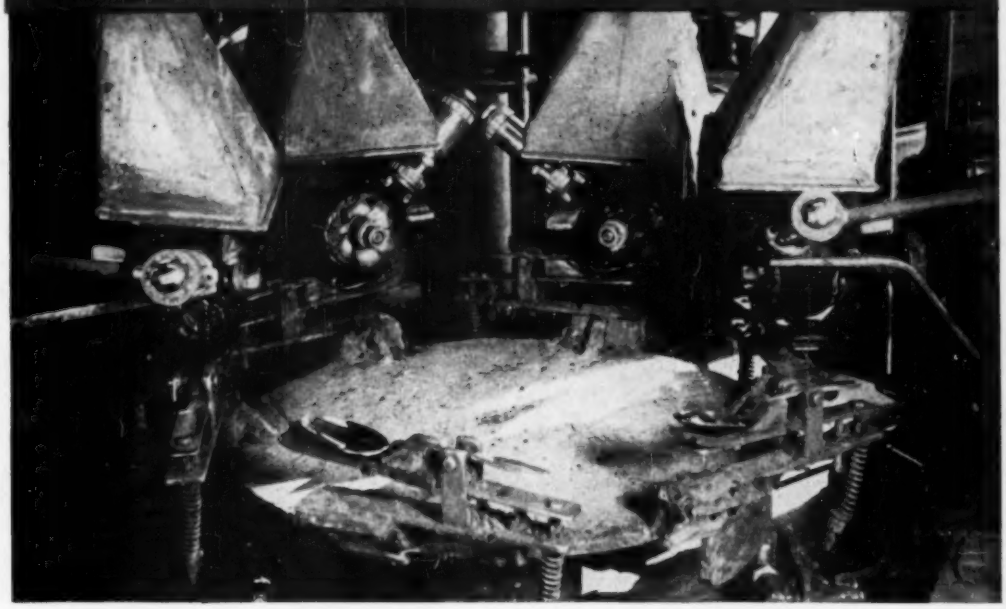

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